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MALIGNANT DISEASE OF THE NASAL ACCESSORY SINUSES, WITH A REVIEW OF ELEVEN CASES.*†

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Introduction: Charity patients often seek relief from disease late, or even very late, so that an early diagnosis cannot be made. Pain and hemorrhage are usually late symptoms of malignant disease; therefore, the milder symptoms do not attract the patient's attention early as they should. Modern preventive medicine and surgery cannot function for ignorant people very often. This is particularly true of patients admitted to Colorado General Hospital, with and without malignant disease, as most of these patients come from isolated sections of the State. Houser[1] says "the prognosis varies inversely with the ease of diagnosis." A late diagnosis of malignancy usually means a poor prognosis. The members of the staff are, therefore, forced to give these unfortunates the best and most humane treatment the circumstances will permit. This sometimes means little more than palliative measures. The nearness of the tumor, in the sinuses, to such important structures as the meninges, brain, orbit, optic chiasm, etc., with involvement of bony structures, makes the saving of life very difficult. This leaves much to be desired.

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Lederer[2] believes "that a malignant neoplasm of a nasal sinus is seldom, if ever, confined within a mathematically calculable area. By virtue of the characteristically slow growth within a bony cavity it is observed as such at a time when it falls within the classification of inoperability; that is, when the diagnosis finally becomes self-evident."

This is a relatively small series of cases, but it represents all those of proved malignancy of the sinuses cared for in the institution from September, 1924, to the close of 1936, inclusive.

Phillips,[3] in 1898, called attention to the importance of malignant tumors of the sinuses. There had been occasional reports before that, but his report emphasized the importance of malignancy. He reported one case and collected 16 others from the literature.

Age: The *ages* range from 28, the youngest, to 68, the oldest (28, 39, 46, 47, 48, 50, 56, 62, 62, 67 and 68). The average age was 52+. In one of New's[4] series, reported in 1926, the ages ranged from 3 to 77 years, with 50 as the average age. Seventy-nine per cent of his patients were between 40 and 70.

Occupation: The occupations were as follows: Five were farmers, two were laborers, one was a miner, two were railroad men and one was a housewife. Occupation seems to be of very little importance in malignant disease of the sinuses, although it is important in malignancy of other organs, as one of us (Spencer[5]) has previously mentioned.

Sex: There were 10 males and one female. In one of New's[4] reports, 58 per cent of the primary malignant tumors of the maxillary sinus were in males.

In most of the series of case reports of malignant disease of the head and neck appearing in our literature, males are affected more frequently than females. In the report made by one of us (Spencer[5]) last year, of 14 cases of carcinoma of the tongue, from the University of Colorado General Hospital, 13 were males.

Race: There were nine white Americans and two Mexicans. Our reports of malignant disease nearly always include Mexicans, because of the large numbers of them employed in the sugar beet fields of Colorado.

Onset: The onset of the disease preceded admission to the hospital by one month in the shortest case to seven years in the longest. In the patients with a highly malignant type of tumor the duration of life, after the first onset of symptoms, is usually only one or two years.

Glandular Enlargement: The superficial cervical glands were enlarged on one or both sides in at least six of the 11 patients. In the other five the deep cervical glands were almost certainly involved at the time of admission, because the sinuses drain into the deep cervical lymphatics too and the disease had lasted long enough, at the time of admission to the hospital, for these to have become involved.

Serological Tests: The blood Wassermann was negative in all. Other serological tests were made, such as the spinal fluid Wassermann and colloidal gold curve, for a few of the patients and these were negative.

Sinuses Involved: In seven of the patients the maxillary sinus was first involved. In two it was the frontal, in one the ethmoidal and in one the maxillary, ethmoidal, sphenoidal, orbit and hard palate on one side. The sphenoidal sinus was not primarily involved in any, but it was by extension in two.

Davison and Kahr[6] have reported two cases of primary carcinoma of the sphenoidal sinuses with extension, in both patients, to the cranial cavity. Both were inoperable, but the pain and rapid extension were relieved by irradiation. The autopsies showed the extensive invasion of the cranial cavity just prior to death.

Invasion of Other Parts of the Skull: The malignancy invaded the orbit in six cases, the hard palate in five, the zygoma in one, the sphenoidal sinus in two and the ethmoidal in one.

Myerson[7] has reported a case in which the right orbit, right ethmoidal, maxillary and sphenoidal sinuses were all involved by carcinoma. The tumor, including the right eyeball, was removed by surgical diathermy with a very good result.

Fenton[8] has emphasized the importance of early recognition of invasion of other parts of the skull, such as the orbit, optic chiasm, meninges, cheek, oral cavity and cranial cavity.

Exophthalmos was present in several of our cases at the time of admission, because the floor of the orbit was involved. Irradiation had apparently not increased the exophthalmos. Schall[9] read a paper dealing with this symptom before the last Ear, Nose and Throat Section meeting of the A. M. A. He referred to a recent article by Hill,[10] discussed by Goldsmith, in which the prominence of the eyeball following irradiation was called to our attention. He believes the exophthalmos was made worse by irradiation.

Roentgen-ray Diagnosis: The diagnosis was supplemented by X-ray films in all except one. Even when the diagnosis is very evident the X-ray often helps to show extension to other sinuses, the orbit, cranial cavity, optic chiasm, oral cavity, nasopharynx, etc.

Metastasis: Other organs of the body were not demonstrably invaded by metastasis, at the time of admission, in a single case by physical examination and X-rays.

Type of Tumor: Squamous-cell carcinoma is the most frequent type of carcinoma in the sinuses. Bryan[11] has reported a papillary type of carcinoma.

Our ninth case at first suggested clinically that the tumor might be sarcoma, but the pathological report was squamous-cell carcinoma. Stone[12] believes sarcoma is more frequently encountered in the maxillary sinus than carcinoma. This has not been our experience, nor do the numerous reports in the literature substantiate this.

Hartz[13] mentions the similarity of onset of carcinoma and sarcoma in the maxillary sinus. He says, "If it arises from the floor there are dental signs first, such as neuralgia about the teeth. If it arises in the ethmoidal cells or the orbital plate there may be swelling around the eye or puffiness over the cheek and this swelling will be more persistent than in sinuitis."

Dentists have often been urged to extract bicuspids and molars from the upper jaw to relieve pain, only to find after the extraction the pain was caused by a malignant tumor of the superior maxilla and not by dental disease.

Biopsy: A biopsy was done in eight of the 11 cases. In the remaining three the disease was so far advanced a biopsy

was not performed and these three latter were probably all cases of carcinoma. The clinical diagnosis of malignancy of the sinuses is usually not difficult. However, the biopsy is very necessary, especially in early cases, to determine the exact type of malignant tumor.

The method used so much by Dr. Gordon B. New, of the Mayo Clinic, of doing a biopsy while the patient is on the operating table is excellent. He insists the specimen be carefully guarded to avoid any possible confusion with other specimens. The report from the pathologist enables him to decide what type of surgical procedure is best. This is more logical than doing a biopsy one day and the operation the next. The more malignant the tumor the more thorough the surgical excision must be, if surgery is used, and the more thorough the irradiation must be.

Beck and Guttman[14] "have elaborated a dictum that the biopsy determines the details of treatment."

Beck and Guttman[15] also say, "It is only since the recent collaboration of both the pathologist and the radio histologist that one has been able to gain some information regarding the value of the minute picture of the neoplasm as regards the course that the disease pursues and its response to therapy. It has been found that cellular types of neoplasms, which clinically are so highly malignant, and metastasize so readily and extensively, are very frequently the most radiosensitive. For instance, it has been found that neoplasms that are undifferentiated in character, so-called anaplastic lesions, that are highly cellular, and show no tendency towards adult structure, are the ones that are most easily influenced by radio therapy, whether radium or X-ray. The lesions that show a tendency towards adult characteristics—for instance, the acanthotic lesions of a squamous-cell carcinoma, that show pearl formations and regular pavement-like tissue structure — respond very poorly to irradiation. These are best handled by extensive surgical destruction."

The final diagnosis usually rests on the biopsy. The macroscopic appearance may be studied at the time of the examination, in the operating room and at the autopsy.

Quick,[16] in 1930, offered the following suggestions: "*1.* Surgical exploration and biopsy should be done earlier for early

diagnosis. *2.* Surgical principles in treating new growths elsewhere do not apply to the sinuses as a rule. *3.* Radium and Roentgen radiation are of value and should be used in conjunction with surgical treatment. *4.* Radium and Roentgen radiation, if used in sufficient dosage, can be depended upon to eradicate the lesion. *5.* Surgical intervention must be used to secure exposure and drainage. *6.* The anatomy of the parts makes infection more of a hazard than elsewhere."

Operable or Inoperable: Six of the 10 were regarded as inoperable at the time of admission. One refused operation. Two had a Caldwell-Luc operation and two a Barnes[17] operation, as suggested by Dr. Harry A. Barnes, of Boston.

The English otolaryngologists were prone to use surgery alone without irradiation, according to a discussion of this subject in 1922 at the March meeting of the Laryngological Section of the Royal Society of Medicine, according to Woodman.[18] However, their attitude has changed since 1922, as shown by their discussion in 1931 at a meeting of the same Society.

The Caldwell-Luc operation or the Denker may be sufcient for early malignancy of the maxillary sinus. The modified Lynch operation, the Moure, the Barnes, the Preysing or the Kocher may be required for other patients. The operation which will best enable the surgeon to expose and remove the malignant tumor is the one of choice. Even then the operative technique must be altered from time to time to meet the emergencies of the case.

Davis[19] has reported the results from 39 cases during a five year period. He followed many of the cases. Of those followed, 13 had epitheliomata, four round-cell sarcomata, seven endotheliomata, and two spindle-cell sarcomata. The others could not be followed.

Thompson[20] has reported a series of cases in which surgery followed by deep Roentgen-ray therapy and radium combined gave better results than any one method of treatment alone.

Nash[21] recommends the cautery, surgical extirpation, endo- of the sinuses and he employed them in any combinations thermy, X-rays and radium in the treatment of malignancies

that were possible at one particular time. He has reported his results in nine cases during a three and one-half year period. He reported five patients dead and a sixth not expected to live. A seventh had a slow-growing sarcoma. The eighth and ninth were cured.

Shutes[22] reported a patient cured after five years. He removed, by means of a Caldwell-Luc operation, a papillary squamous-cell carcinoma from the left side of the nose and the left maxillary sinus. This was followed by dessication with surgical diathermy and by irradiation with radium and the Roentgen-ray.

Irradiation: All received at least some irradiation from either radium or the Roentgen-ray except two. Many had extensive irradiation; some before admission, during their stay in Colorado General Hospital and after leaving the hospital. The radiologist at Colorado General Hospital often has to work at a great disadvantage, because he does not know, and cannot always learn, how much irradiation the patient had received before admission. Some of the older Roentgen-ray machines do not measure dosage accurately. Our radiologist must often use too little therapy in order to avoid burns and the severe criticism which is so likely to be provoked by burns.

New[4] says, "The combination of cautery and radium as employed in the Mayo Clinic for the treatment of malignant tumors of the antrum of Highmore has eliminated the operative deaths usually associated with this disease, and has produced a higher percentage of cures than previous operative measures."

Greene[23] and Barnes[24] have reported the good results of the combined operative and radium treatment of malignant tumors of the maxillary sinuses. Greene reported 84 cases of carcinomata treated at Huntington Memorial Hospital.

Radium in substance, radium emanations and particularly the radium bomb or telioradium of 4 gm. of radium used from different angles has greatly improved radium therapy. We do not have enough radium for a bomb at the University of Colorado General Hospital. Hill[10] has recently mentioned this difficulty in the management of malignant disease of the sinuses as well as others. Only a few large metropolitan areas have radium bombs.

Deep Roentgen-ray therapy is another big improvement in irradiation. The 900,000-volt Coolidge X-ray tube insures penetration of the sinuses.

Ohngren[25] favors the combined use of endothermy and irradiation rather than irradiation alone.

Johnson,[26] in 1924, in a series of 24 cases, used radium alone without surgery or the Roentgen-ray. He inserted the radium directly into the sinus and used some on the face and neck surfaces. Four of his patients showed no clinical evidence of malignancy for from one to five years afterward. Three were free from the disease one, three and four years, respectively. One was free from the disease for six and one-half years, but the disease recurred later. Eight patients improved while under treatment but were not free from the disease at any time. The remaining eight patients lived four years.

Robinson[27] reported 10 cases in 1933 treated with radium, all well, for from two to 14 years without recurrence.

McCoy[28] reported a case of sarcoma of the maxillary, ethmoidal and sphenoidal sinuses on one side treated with 25 mg. of radium screened with 1 mm. of brass and placed in the antrum, and 25 mg. of radium screened with 1 mm. of brass placed in the ethmoidal and sphenoidal region after the sarcoma had been surgically removed. After three treatments, over a period of one month, the pain, swelling and hemorrhage had all disappeared.

Syphilitic glossitis often precedes carcinoma of the tongue and the chronic irritation of the glossitis favors malignancy. In the sinuses syphilis seems to play a less important role.

In a case previously reported by one of us (Spencer[29]) of primary cholesteatoma of the sinuses and orbit, the chronic irritation finally resulted in a squamous-cell carcinoma of the right maxillary sinus, right orbit and right frontal.

Chronic granulomata of the nose and sinuses often produce enough irritation to excite malignant disease as shown by one of us (Spencer[30]) in the Jackson and Coates textbook, The Nose, Throat and Ear and Their Diseases, published by W. B. Saunders Co., Philadelphia, 1929, pp. 186-197.

Harmer[31] has reported 23 cases. Of these 18 had carcinomata, all treated surgically with only two deaths soon after operation. Only two patients with carcinomata treated by excision of the tumor were living, without recurrence, after three years. He used excision followed by diathermy and radium.

New,[32] in 1933, reported one case of squamous-cell epithelioma living after 10 years and without recurrence.

New and Cabot,[33] in 1935, reported their results in 295 patients with malignant tumor of the antrum and upper jaw. They emphasize the importance of using surgical diathermy, the cautery and radium. They show better results from this method of handling their cases than was previously obtained by surgical removal of the upper jaw, as many patients die following the latter operation.

New and Cabot[33] mention Ohngren's work, as we have done, and they have the following to say about it: "The literature on this subject recently has been very carefully reviewed in a monograph by Ohngren. He traced the development of electrosurgery and irradiation in the treatment of the condition on the Holmgren service of the Sabbatsberg Clinic at Stockholm. At first, the 'soldering iron,' or 'ferrum candens,' was used; large electric cauteries were then developed; and, finally, electrosurgery. Ohngren reviewed both the foreign and American literature, and his monograph is an outstanding contribution to the subject. He has evolved a clinical classification of his own for determining malignancy of the tumor, in which he combines the position of the growth, with regard to whether indications for operations are favorable or unfavorable, its activity, determined microscopically, and the presence or absence of metastasis. He divides the skull, by means of an imaginary plane passing through the inner canthi and angles of the mandible, into an anterior-inferior or less dangerous portion and into a posterior-superior or more dangerous portion. In turn, each of these portions is further divided into four regions, two lateral and two medial. Tumors in the medial posterior-superior regions are much more dangerous and treatment is more likely to result in a smaller percentage of cures than with those in the lateral anterior-inferior regions."

Many unimportant portions of the history, negative physical findings and negative laboratory tests have purposely been omitted.

Case 1: J. E. B., male, age 48 years, married, occupation miner, admitted March 31, 1926, and discharged April 16, 1926, as unimproved. The diagnosis on admission was carcinoma of the right maxillary sinus.

His chief complaint was of swelling and pain in the right side of the face.

His illness began in July, 1925, with an abscess in the upper gum on the right, near the corner of the mouth. This gradually became worse, so that by the following September he had to quit work because he was so weak. In October, 1925, he had an operation in another hospital for the removal of the swelling of the gum over the right maxilla. In spite of this operation he grew worse. In February, 1926, he had a second operation, at the same hospital, and this time some bone was removed from the right maxilla. Just before the second operation he had two Roentgen-ray treatments. His condition became more serious during the five days prior to admission to Colorado General Hospital; the pain was more severe; and he was unable to open his right eye.

At the physical examination the right eyelids were closed. No inflammation was found when the lids were opened. The right pupil reacted to light. The left pupil reacted to light and accommodation. The right side of the face was swollen, immobile and injected. The patient was unable to open the mouth wide enough for a satisfactory examination. The teeth had all been extracted. The glands in the right side of the neck were markedly enlarged.

The ear, nose and throat consultant reported the nose negative. The nasopharynx was too sensitive to examine. The tonsils were small and infected. A portion of the right superior alveolar process had been removed surgically, exposing the maxillary sinus filled with a sloughing tumor mass with a very bad odor. This was probably carcinoma. The right upper lid could not be opened. The vision was about equal in the two eyes after forcing the right lids apart. The right pupil was smaller than the left and there was exophthalmos of O.D. The movement of O.D. was greatly restricted.

The general surgical consultant recommended codein at night for relief of pain and restlessness. He advised radiation.

The chief of the ear, nose and throat service believed the case inoperable but suggested a trial with radium. A biopsy was not performed.

The radiologist reported marked fibrosis involving both hili and the whole bronchial system, but no X-ray evidence of tumor metastasis. There was a large rounded shadow of almost homogeneous density occupying the region of the right maxillary sinus and floor of the orbit. The right zygomatic bone appeared thin and partially destroyed. His opinion favored malignant tumor of the right antrum.

The laboratory reported the blood Wassermann negative. The urinalysis was negative. The red blood cells numbered 4,940,000 and the leukocytes 12,200.

The final diagnosis was carcinoma of the right maxillary sinus and orbit.

The patient's progress was not very satisfactory. He was discharged April 16, 1926, as unimproved. The final outcome is not known, as the social service department cannot trace him.

Case 2: C. C., white, male, age 50 years, married, occupation farmer, admitted March 20, 1931, and discharged March 27, 1931, as improved. The admission diagnosis was carcinoma of the frontal bone.

His chief complaint was of a growth on the forehead and of frequent sore throat.

His present illness started at the age of 17 years with a small lump in the middle of the forehead. This slowly increased in size until seven years ago; it was about the size of a nickel and twice as thick, when it was treated with radium by a dermatologist. About two years ago there was a slight recurrence. At the time of admission there were nodular areas completely surrounding the old scar.

The physical examination showed a well developed and well nourished man somewhat younger than his stated age. The nose was negative. The pupils were round and equal. The reactions to light and accommodation were normal. The eye movements were normal.

In the frontal area, just superior to the nasal bones, and slightly to the right of the midline, in the region of the right frontal sinus, there was an old scar of the skin and subcutaneous tissues. This was adherent to the bone. Surrounding the scar there was a nodular subcutaneous growth most marked to the right of the growth and superiorly. It extended laterally 2 or 3 cm. The area was about three times the normal thickness. There was slight tenderness to manipulation in this area.

The tongue protruded in the midline and presented a slight peripheral tremor. The gums were injected at the margins. The teeth were poorly cared for. The tonsils were enucleated. The posterior pharyngeal wall was congested and granular. The blood Wassermann was negative. The urinalysis was negative. The red blood cells numbered 5,060,000 and the leukocytes 10,100. A biopsy was not performed.

The provisional diagnosis was carcinoma and probably squamous-cell. Also sinuitis of the right frontal.

Fifty mg. of radium, screened with a 2 mm. of lead, at a distance of 1 cm., was applied on March 25 and 26 for 16 hours each day. On the twenty-seventh the same radiation was used for six hours. He was discharged on the twenty-seventh to await results. The social service department has not been able to trace him.

Case 3: E. H., Mexican, male, age 47 years, married, laborer, was admitted on Sept. 6, 1931, with a diagnosis of carcinoma of nasal polypi. He was discharged Sept. 24 1931, as unimproved.

His chief complaint was of nasal obstruction and nasal hemorrhages.

In April, 1931, he had an attack of influenza characterized by severe headache, generalized aching, malaise, fever, etc. Following this he was unable to breathe through the right side of the nose. A physician gave him a nasal spray and the right side became all right. Then the left side closed. There was apparently a good deal of discharge from the nose and in May he began to blow big clots from his nose. His breathing through the nose improved for a while. The hemorrhages became worse. A physician found the left side of

the nose closed by a mass of tissue. A biopsy was performed and the tissue sent to the University of Colorado School of Medicine. The pathologist reported squamous-cell carcinoma of nasal polypi. Shortly before admission he had a little pain over the left frontal region and in the left orbital cavity.

The physical examination showed a very well nourished Mexican of powerful physique sitting quietly in the ward in no apparent distress. The pupils were equal and regular. Both reacted to light and accommodation. The eye movements were normal. There was no nystagmus or strabismus. The sclerae and conjunctivae were negative. The left nasal fossa was completely obstructed and the right partially so. There was a mucoid, bloody secretion coming from the nose. There was a white, glistening mass of tissue in the left side which bled freely upon manipulation. The left frontal and maxillary sinuses were dark by transillumination. The teeth were in very poor condition. Many had been extracted. The gums were retracted, discolored and infected. The mouth was filthy and the breath foul. The tongue protruded in the midline and there was no tremor. The tonsils were of normal size and apparently chronically infected, because the blood vessels were injected and the anterior pillars red.

The provisional diagnosis was carcinoma of the nasal accessory sinuses on the left.

On Sept. 15, 1931, there was an abscess of the left cheek which was opened under gas anesthesia and foul-smelling pus evacuated on the seventeenth. He was much better on the eighteenth.

The radiologist reported all sinuses on the left, except the frontal, homogeneously opaque, probably due to tumor invasion.

The blood Wassermann was negative. The urinalysis and blood count were negative.

The patient's condition was considered inoperable. He was given deep Roentgen-ray therapy on Sept. 9, 11, 13 and 19. He was discharged on the twenty-fourth as unimproved. The social service department has not been able to follow this patient.

A biopsy specimen taken from the nose consisted of a mass of soft gray tissue 1 cm. in diameter. Microscopic examina-

tion of this revealed an edematous, fibrous stroma resembling that of a nasal polyp, invaded by groups of acidophilic polyhedral- and pyramidal-shaped epithelial cells. A tendency of these cells to form small clusters was seen. The nuclei were large and finely reticular. Mitotic figures were numerous. The cell groups were suggestive of neither glandular nor pavement arrangement, and none of the characteristics of squamous epithelium, such as keratohyalin granules, epithelial pearl formation, or spinous processes were seen. The growth bears a resemblance to squamous-cell carcinoma, but was distinguished by the absence of the above mentioned features. The surface was partly covered by an atrophic layer of pseudostratified columnar epithelium, changing to thin stratified squamous. There was extensive ulceration and suppurative inflammation near the surface. Where a surface layer of epithelium was present it had no evident relationship to the tumor cells. The tumor represented a sub-variety of epidermoid carcinoma, variously known as transitional cell carcinoma, lymphoepithelioma or Schmincke tumor. It originated in mucous membranes with a stratified squamous epithelium, frequently that covering lymphoid tissue, as in the nasopharynx. The primary growth may be small, while secondary growths in the lymph drainage area are bulky. It may on this account be confused with branchiogenic carcinoma or with a primary tumor of the cervical lymph nodes.

According to Ewing,[34] the transitional cell carcinoma of the nasopharynx has "been recognized by many authors, but has never been sufficiently emphasized. It should be noted that surgical results in this type of epidermoid carcinoma are poor owing to numerous and widespread metastases, while the undifferentiated character of the cells renders them highly susceptible to radiation. The primary tumor and the cervical metastases may often be cleared up by heavy external radiation, but most of the cases eventually succumb to internal and distant metastases."

Case 4: M. E. A., female, age 62 years, white, widow, was admitted Dec. 13, 1932, and discharged Dec. 19, 1932. The diagnosis on admission was carcinoma of the left maxillary sinus.

Her chief complaint was of pain, tenderness and swelling of the left cheek.

She had catarrh of the nose for a year before admission, which bothered her only when she had a cold. About three months before admission she noticed the whole left side of her face was swollen, but this was more marked under the eye and over the cheek bone. There had not been constant pain, but the cheek was tender to pressure and to cold. There had been more discharge, with a foul odor, from her left

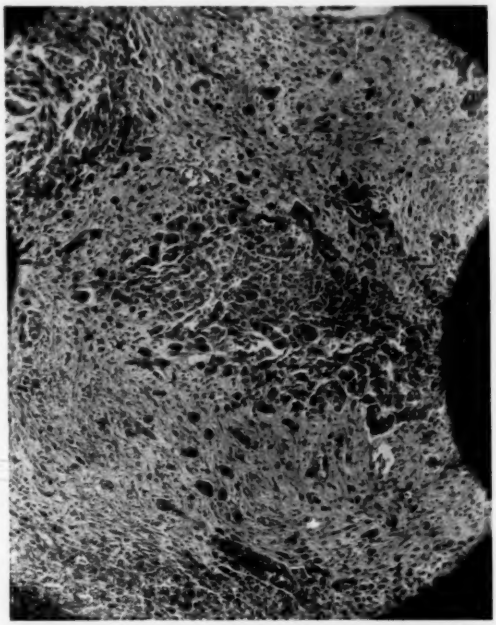

Fig. 1. Case 3: Squamous-cell carcinoma of left superior maxilla, orbit, ethmoid and sphenoid magnified 75X.

nostril since the swelling started. She had lost 18 pounds during the three months before admission.

The physical examination revealed a poorly nourished white woman, with a dark skin and of stated age, lying in bed quietly with a swelling under the left eye. There was a swelling over the left maxillary sinus with some serous discharge at a point inferior to the outer canthus. The left eyelids were partly closed due to the edema from below. The pupils

were equal and regular, and reacted to light and accommodation. The left side of the nose was partially occluded due to the lateral pressure. The throat was negative. There was some cervical adenopathy.

The blood Wassermann and urinalysis were negative. The red blood cells were 3,760,000. The leukocytes were 6,450.

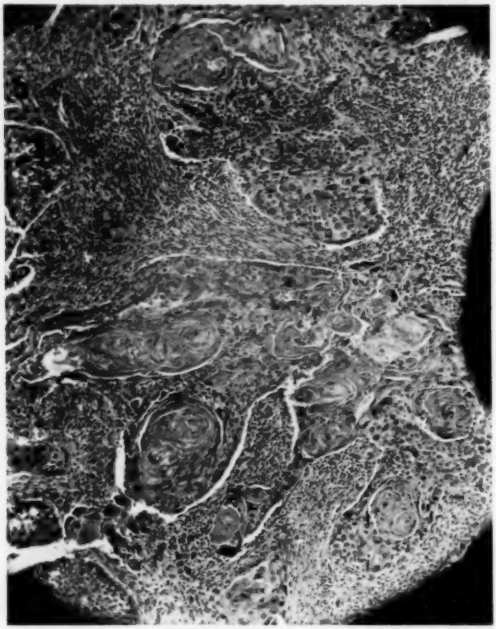

Fig. 2. Case 4: Squamous-cell carcinoma of left maxillary sinus magnified 75X.

The provisional diagnosis was malignancy of the left maxillary sinus.

A biopsy was performed and showed a squamous-cell carcinoma. She was given her choice of a radical operation or deep Roentgen-ray therapy after the disease had been explained to her. She elected to have deep Roentgen-ray therapy. She was discharged to the out-patient department as unimproved for this treatment.

The tissue received was a biopsy of the left antrum, and consisted of fragments of firm, pale tissue. Microscopically the tissue was composed of broad sheets of large, pale, polyhedral epithelial cells infiltrating a dense fibrous stroma in which there were large numbers of lymphocytes, plasma cells and eosinophilic leukocytes. The epithelial cells possessed spines, occasionally keratohyalin granules, and formed many epithelial pearls. Mitotic nuclear figures were numerous. The structure was that of a moderately well differentiated squamous-cell carcinoma.

She died in October, 1935.

Case 5: R. B. W., white male, age 28 years, occupation railroad brakeman, single, admitted Dec. 19, 1932, and discharged the first time on Feb. 22, 1933. He was readmitted several times during the subsequent six months for re-examination and treatment. He made a complete recovery and is living and well. The diagnosis on admission was tumor of the left maxillary sinus.

His chief complaint was of swelling over the left side of the face and under both eyes. There was some soreness over the right side of the face.

Three years before admission he had a small nodule removed from his right foot and all his upper teeth extracted. Some of the upper teeth were abscessed. The left maxillary sinus became infected and a fistula formed through the alveolar process. The sinus was frequently washed through this fistula. The sinus infection improved except for the swelling of the left side of the face. His nose had been almost completely obstructed during this three year period. One month before admission he began to have headaches, especially after stooping over. Heat was applied for one week. One week before admission a physician attempted to open the left maxillary sinus through the nose and wash the sinus, without success. Both lower eyelids began to swell five days before admission and the conjunctivae became bloodshot, but the right more than the left.

The physical examination revealed a well nourished white male, of about the stated age, lying quietly in bed breathing through his mouth and with the face swollen. The left side was worse. The conjunctivae were injected and the right

more than the left. There seemed to be some exophthalmos on the left. The pupils reacted to light and accommodation, and were regular and equal. There was complete obstruction of both sides of the nose and mucous membranes were injected. All of the upper teeth had been extracted and some of the bone had been destroyed on the upper left. The tongue protruded in the midline. The tonsils were out. The pharynx was negative. The cervical and submaxillary glands were enlarged bilaterally. The thyroid could not be palpated. The

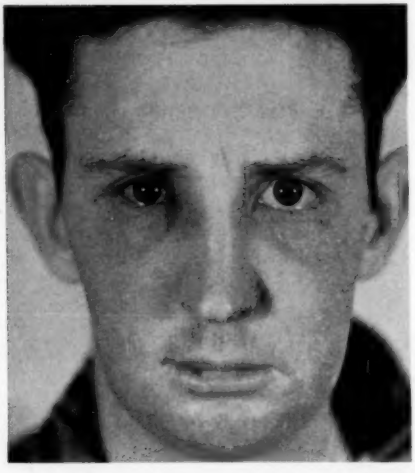

Fig. 3. Case 5: Photograph of patient, taken three days after admission, with neurogenic sarcoma of the left maxillary sinus.

chest was symmetrical and the expansion equal. There was a mass to the left of the posterior spinous process of the tenth thoracic vertebra. This was nodular, firm and attached to the underlying tissues.

The urinalysis, blood count and blood Wassermann were all negative.

The provisional diagnosis was tumor of the left maxillary sinus, probably sarcoma.

A biopsy was performed on Dec. 21, 1932, under local. The tissue showed suppurative inflammation with necrosis.

The radiologist reported the frontal sinuses were absent. There was marked homogeneous cloudiness over the left maxillary sinus and left ethmoidal. The sphenoidal sinuses, the right maxillary and the right ethmoidal were hazy. There was some erosion of bone over the oral aspect of the hard palate on the left, but no definite evidence of osteomyelitic involvement of the bony walls of the sinuses.

On Dec. 31, 1932, a Caldwell-Luc operation was performed on the left maxillary sinus under local. The bony walls were found with cystic material and much chronic inflammatory tissue was removed.

On Jan. 6, 1933, tumors were removed from the back, right arm and forearm under a local anesthetic.

The patient received a series of deep Roentgen-ray treatments over a period of months. He was finally discharged as symptom free. He is living and well almost at the end of the five year period.

Multiple tumors were present, but the first to cause serious symptoms was located in the left antrum. A biopsy of this tumor was made and later similar tumors were removed from subcutaneous sites on the back and left arm, the latter being attached to the median nerve. A tumor diagnosed elsewhere as a fibroma had been previously removed from the tendon of the right great toe. A subcutaneous tumor of the right thigh appeared between the time of the patient's first and second admissions to this hospital, which was not removed, but was treated by X-ray.

Aside from inflammatory changes present in the antral tumor, all were alike in structure. They were composed of small spindle-shaped cells with abundant fibrillar intercellular substance containing fairly numerous thin-walled blood vessels. The cells were in bundles cut in many planes, and where these were cut longitudinally a tendency to parallel arrangement with palisading of the nuclei was seen. This arrangement was nowhere well defined, and in many areas was completely lacking. The nuclei varied greatly in size, shape and staining quality, but mitotic nuclear figures were not found.

In certain areas the intercellular substance was vacuolated, and such sections stained for fat showed the presence of small, fat droplets. The amount of intercellular substance

varied in different parts, and in some locations the stroma was fibrous and partly hyalin.

In sections of the tumor of the antrum, hemorrhage, necrosis and leukocytic infiltration were prominent, and no capsule was evident. In the tumors of the back and arm, a heavy fibrous capsule was present.

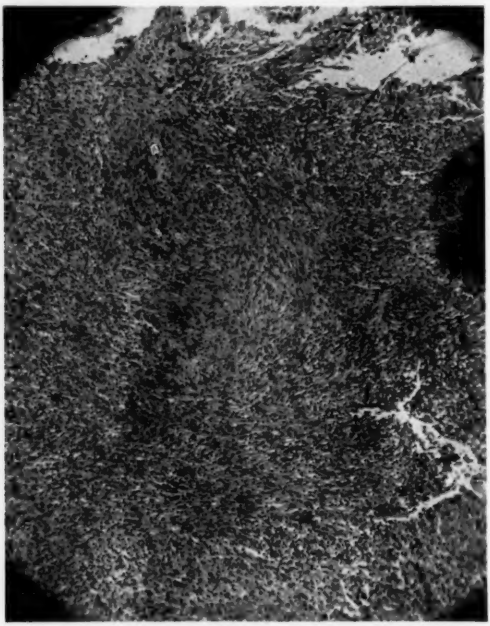

Fig. 4. Case 5: Neurogenic sarcoma of left maxillary sinus, orbit, hard and soft palate magnified 75X.

The histologic structure of these tumors was consistent with that of neurogenic (neuro) sarcoma. Stewart and Copeland[35] point out that many sarcomas of soft parts are neurogenic and are similar both clinically and histologically to the lesions of von Recklinghausen's disease. These may frequently be associated with one or more of the stigmata of this condition. In this patient multiplicity of the tumors was suggestive of neurofibromatosis, but skin pigmentation was not noted, and no family history of the disease was recorded.

The location of one of multiple tumors in the antrum was incidental in this case, as such tumors may occur anywhere in the body.

Recurrence after excision is common in neurosarcoma. The effect of irradiation in preventing or delaying recurrence following excision is not clearly defined. In general, prognosis is poor. The tumors vary in degree of malignancy, from slow growing or stationary fibrous encapsulated tumors to rapidly growing infiltrating and metastasizing types.

In this case no recurrence of the antral or arm growths had been observed within six and one-half months after removal. The tumor of the thigh had not increased in size following irradiation.

Case 6: W. O. R., white, male, age 68 years, occupation farmer, married, admitted Oct. 17, 1933, and discharged Dec. 13, 1933, as improved. The diagnosis on admission was malignant disease of the left maxillary sinus.

His chief complaint was of a burning sensation and swelling of the left side of the face, with constant headache in the region of the forehead.

One year before admission he began to have rather severe generalized headaches, especially upon arising in the morning. Six months later the headaches became more severe and localized between the eyes and just above the eyebrows. This was especially severe upon stooping over. He consulted his physician, who told him he had sinus trouble and did an operation for the removal of "some bones." Two days later the surgeon cut something open in the side of his nose. Following this his face began to swell; the headaches became more continuous; and his hearing became less acute on the left side. The surgeon then sent him to Colorado General Hospital. He had lost 14 pounds since the first operation was performed.

The physical examination showed a normally developed, rather poorly nourished, white male, walking about, complaining of pain and swelling of the left cheek. The conjunctivae were normal. The corneae were normal. The left eye watered rather profusely. The pupils were regular and equal. They reacted sluggishly to light and accommodation. There

were crusts in the anterior naris on the right. There was profuse mucoid secretion on the left. All of the nasal mucous membranes were congested and swollen, but worse on the left. The left cheek, over the maxillary sinus, was swollen, red and tender. Many of his teeth had been extracted. Those he had were badly decayed. There were many cavities and old fillings. The gums had receded. The tongue was clean and it protruded in the midline. The tonsils were atrophic.

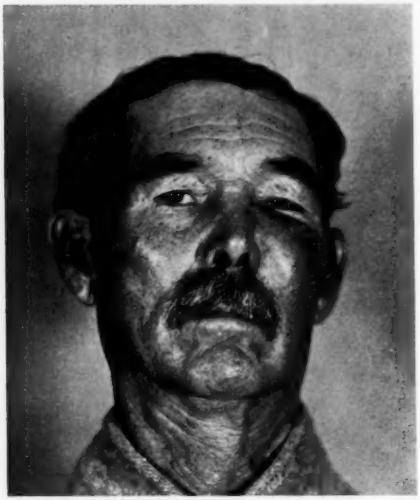

Fig. 5. Case 6: Photograph taken two weeks after admission and just before operation for plasmacytoma.

The radiologist reported the left frontal sinus hazy and the left maxillary, ethmoidal and sphenoidal markedly cloudy. The urinalysis, blood count and blood Wassermann were all negative.

On Oct. 21, 1933, a Caldwell-Luc operation was performed with the removal of a soft tumor which filled the left maxillary sinus. A similar tumor was removed from the left middle meatus. A frozen section was positive for malignancy and probably carcinoma.

On Nov. 8, 1933, an extensive external rhinotomy was performed with evacuation of all of the sinuses on the left side except the frontal.

On Nov. 11, 1933, radium was placed near the posterior wall of the left maxillary sinus. The 50 mg. were screened with 1 mm. of brass and 2 mm. of lead at a distance of 1 cm., and left for 48 hours.

On Nov. 24, 1933, the same radiation was used for 38 hours under the skin of the anterior maxillary wall. On Dec. 3, 1933, the patient's condition was greatly improved and the wound was healing satisfactorily. The patient was discharged on Dec. 13, 1933, in a very satisfactory condition.

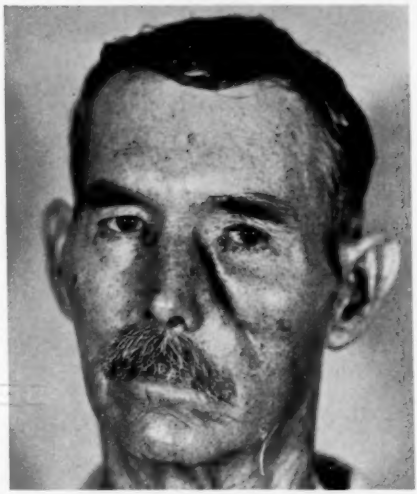

Fig. 6. Case 6: Photograph taken one month after radical operation for removal of plasmacytoma.

The final diagnosis was plasmacytoma.

Plasmacytoma of a sinus is apparently rather rare. However, Walgren[36] has reported 125 occurring in the long bones, of which 35 were of a definite plasma cell type.

The patient was readmitted on July 17, 1934, for re-examination, observation and treatment. There was no Roentgen-ray evidence of metastasis to the osseous system. There was no evidence of recurrence. The external wound was closed under local. Tumors of the right cubital fossa were removed under local also. His general condition was not very good

and the prognosis was poor. He was discharged on Aug. 11, 1934. The social service department has not been able to follow this patient.

This case has been previously reported by Dr. Kemp G. Cooper[37] as a solitary plasmacytoma. Since his report new tumors have occurred. The biopsy specimen consisted of a number of small soft white pieces of watery tissue from the antrum and nose. The operative specimen consisted of several pieces of fairly firm whitish-gray tissue, the largest measuring 3 x 2 x 0.5 cm. Following the operation and subsequent irradiation the patient was discharged as improved, to return for observation and further radiation therapy. On his return in two months there was no evidence of recurrence at the operative site, but two tumors, one of walnut size, the other of pea size, of one month's duration, were present beneath the skin of the right cubital fossa. These tumors were removed surgically. Grossly the larger was firm, pink spheroidal, smooth on one side, rough on the other, with tabs of adipose tissue attached.

Microscopically, all tumor tissue from various sites, including the nose, antrum and arm was alike and was composed of solidly grouped large, round or polygonal cells with violet staining cytoplasm and deeply basophilic eccentrically placed nuclei. Double nuclei and mitotic nuclei were frequently seen.

In the tumor tissue from the nose and antrum the surface was partly covered by pseudostratified columnar epithelium, and the tumor cells were in solid masses in the edematous lamina propria beneath it. In the arm tumor the cells formed a solid nonencapsulated mass lying in a fibrous and adipose tissue stroma. The close resemblance of these cells to plasma cells was apparent, and was very evident in pyroninmethyl green stained sections, where the characteristic polychrome reaction was seen. The diagnosis of malignant plasmacytoma was made upon clear-cut histological evidence.

No evidence, either X-ray or clinical, of bone involvement existed in this case, distinguishing it from either multiple or solitary myeloma of bone. The arm tumors were probably metastatic, but may have represented multicentric foci. The clinical and pathological features of such tumors has been reviewed by Blumenfeld.[38] It would appear that plasmacytoma, apart from the tumor of bone, is fairly frequently

found in the upper respiratory tract. That such tumors are true neoplasms is generally accepted. The cause is unknown. Inflammation may be a predisposing factor. The histologic relationship of solitary extraosseous plasmacytoma to multiple myeloma of bone is apparently very close, but the clinical manifestations are quite different, as noted by Cooper.

Fig. 7. Case 6: Plasmacytoma of left maxillary sinus magnified 75X.

Jackson, Parker and Bethea[39] believe that plasma cell tumors belong to the group of malignant lymphomata, and that all, including multiple myeloma, are interrelated, occurring as a result of the same fundamental process.

Case 7: J. Q., male, age 56 years, white, married, admitted the first time on Oct. 18, 1934, and discharged the first time on leave Jan. 10, 1935. The diagnosis on admission was neoplasm of the right maxillary sinus.

His chief complaint was of swelling in his nose.

The patient first noticed trouble in March, 1934, when a small lump appeared and his right nostril became so full he could not breathe through it. The area gradually became larger and deeper red in color. By May, 1934, it had become large enough to make the right eye swell shut. The area had not been painful or tender. His vision was not affected. He had more discharge from his nose after the mass started to form. Following an operation in August, 1934, he was unable to breathe through his nose. There had been some bloody discharge from the left side.

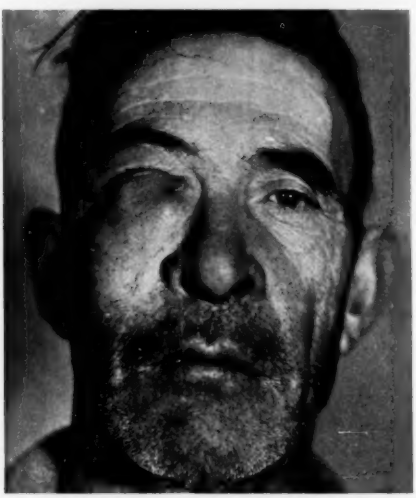

Fig. 8. Case 7: Photograph of patient, taken four days after first admission to the hospital, with squamous-cell carcinoma.

The physical examination revealed a well nourished white male, age about 55 years, lying quietly in bed complaining of a swelling on the right side of his face which had closed the right eyelids and the right side of the nose. His left pupil reacted to light and accommodation. The movements of the left eye were normal. On the right he had a typical Horner's syndrome. The area about the eye was red and swollen, with some purulent discharge in the palpebral fissure. The pupillary reactions were sluggish and the conjunctiva injected. The left side of the face was normal. On

the right there was a hard, firm, nodular mass about the size of a hen's egg which was very red. The left side of the nose was externally negative. The right side was edematous, red and swollen. It contained a little discharge. A number of teeth had been extracted. Many teeth were carious. The gums had pyorrhea. The tongue protruded in the midline and there were no tremors. The pharynx was injected and coated.

The provisional diagnosis was carcinoma of the right maxillary sinus.

Fig. 9: Case 7: Photograph of patient with squamous-cell carcinoma of right maxillary sinus taken after three months of treatment.

The radiologist reported both maxillary sinuses were dense. There was extensive destruction of the superior, inferior and lateral walls of the right maxillary. The right ethmoidal cells and the right sphenoidal sinus were cloudy. The right frontal was negative. The left frontal was small and hazy. The urinalysis, blood count and blood Wassermann were all negative.

On Oct. 24, 1934, the patient had cancerous material removed from the right maxillary sinus, with a rongeur and

curette, under ether anesthesia, by the Caldwell-Luc incision. The pathologist reported a very malignant squamous-cell carcinoma. The same day the patient received deep Roentgen-ray therapy. A radium pack of 50 mg., screened with 2 mm. of lead and 1 mm. of brass, was inserted through the Caldwell-Luc incision. This was left in place for 72 hours.

On Oct. 26, 1934, an area of skin broke down near the nose on the right. This exposed the carcinoma. The ophthalmologist who saw him could not find any orbital involvement.

Fig. 10. Case 7: Photograph of patient with squamous-cell carcinoma of right maxillary sinus taken six weeks before death.

He was discharged on leave Nov. 11, 1934, to return for more treatment, but he did not return until the pain became unbearable.

He was readmitted on Sept. 16, 1936, with a generalized carcinoma of the entire right side of the face. The cervical glands on the right were extensively involved, but the radiologist did not believe the lungs showed evidence of metastasis. There was a large, warty, fungating mass involving the right side of the face, extending into and above the right orbit, compressing the right nasal cavity and extending into

the right side of the mouth. The breath was foul and the patient coughed a good deal. The chest examination revealed slight flatness of the percussion note throughout with diminution of the breath sounds. The chief of the ear, nose and throat service considered further treatment useless. Symptomatic treatment was instituted. The patient died in the hospital on Oct. 31, 1936, following a generalized failure of the cardiorespiratory system.

Fig. 11. Case 7: Photograph of patient with squamous-cell carcinoma of right maxillary sinus taken a few hours after death.

The original biopsy was a small, firm mass of grayish tissue from the antrum. Microscopically there was a loose reticular stroma heavily infiltrated by lymphocytes and polymorphonuclear leukocytes and invaded by coarse bands of polyhedral acidophilic epithelial cells with well defined spinous processes, but without other differential characters. Cells in mitosis were numerous. The tumor was a highly malignant form of squamous-cell carcinoma.

This patient's death occurred Oct. 31, 1936, two years after his first admission, from extension of the tumor. Autopsy disclosed involvement of the meninges and brain.

Case 8: P. J. K., white, male, age 39 years, single, occupation farmer, was admitted on Dec. 27, 1934, and discharged on Jan. 4, 1935, without treatment. The diagnosis on admission was probable primary carcinoma of the frontal sinus with secondary carcinoma of the brain, lower brain stem, etc.

His chief complaint was of pain in the side of the head.

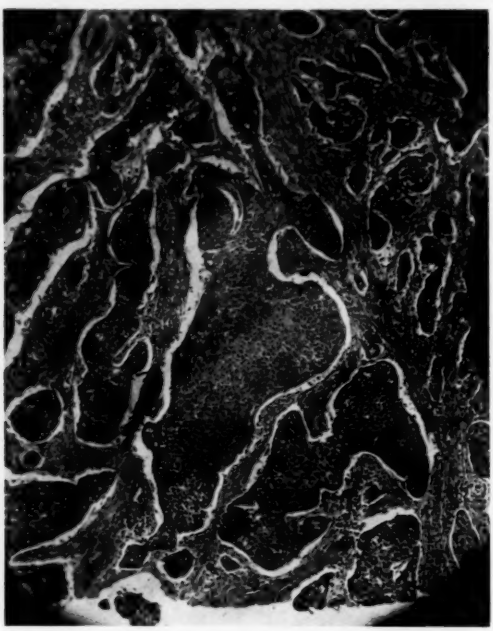

Fig. 12. Case 7: Squamous-cell carcinoma of right maxillary sinus magnified 75X.

He had suffered from pain in the right side of his head, around the right orbit and in the back of his head for six weeks before admission, following what he believed was a sinus infection. He had nausea and vomiting once. On Dec. 21, 1934, several enlarged glands were removed from the right side of the neck. His face was numb over the entire right side, but this was better than it had been. He had not been able to open his right eyelids for two weeks and before that he had diplopia. He was too weak to walk. The

pain was becoming so severe he had to have two or three hypodermics each night.

The physical examination revealed a gaunt, well developed male of about 40 years, lying in bed groaning and apparently in great pain. The skull was very tender over the right supraorbital ridge and along the right side of the nose. The external nose was negative. The right eyelids were closed. The left lids were normal. The conjunctivae were normal. The pupils were round, equal and regular. They reacted to light and accommodation. The left eyeball moved normally except for moderate horizontal nystagmus. The right eyeball did not move. There was vision in each eye. The movement of the right side of the mouth was limited. The teeth were badly stained and worn down to the gum margins. There was a white deposit at the gum margins. The tongue showed a coarse tremor and protruded to the right. The tonsils were normal in size, but contained pus. The pillars were inflamed. There were hard, enlarged glands in the anterior and posterior chains. The glands were discrete with slight to moderate fixation to the skin and deep fascia. There was a recent surgical scar in the right submaxillary triangle. The area supplied by the right second division of the Vth nerve was very hyperesthetic. The nuclei of the IVth, Vth, VIth and VIIth nerves on the right were involved.

The urine contained 1+ albumin, 1+ pus and two red cells. The white count was 10,550, with 68 per cent polymorphonuclears. The Wassermann and Eagle were negative. The radiologist reported marked cloudiness of both frontal sinuses and of the right sphenoidal. The other sinuses were negative. The spinal fluid pressure was 90 mm. of water. The spinal fluid chemistry showed an increase in the sugar and a decrease in the protein. The salt study, Wassermann and colloidal gold curve tests of the spinal fluid were normal. The staff believed the carcinoma had invaded the brain by metastasis.

The patient was kept quiet with narcotics. He was very irritable and at times irrational. His temperature reached 104° on Jan. 4. 1935. The temperature was irregular. No cause was found for this. His lower lip became swollen on Jan. 4, 1935, and was bright red. There was a large ulcer, covered with a grayish-white membrane, on the mucous mem-

brane. This was negative for Vincent's, but it looked like a Vincent's ulcer.

Against the advice of the staff the patient's family physician removed him from the hospital on Jan. 4, 1935. The patient died three days later.

Case 9: A. G., a Mexican, male, age 48 years, single, laborer, admitted March 27, 1936, and discharged May 28, 1936, on leave to return for more treatment. The diagnosis was malignant disease of the right maxillary sinus on admission.

His chief complaint was of constant pain in the right side of the face and nose. There was intermittent pain in the region of the right eye.

He had not had any trouble with his nose until January, 1936, when he thought he had a cold. Late in January he noticed the swelling, which gradually became larger. In February, 1936, his physician opened an abscess (?) below the right eye. Following the operation he had more pain on the right and more swelling. An open wound had remained since the abscess was opened. He had raised sputum ever since he first noticed the growth, but he didn't have any pain in his chest. He felt as if the sputum came from his nose. It had been bloody occasionally. He had difficulty hearing with the right ear.

The physical examination revealed a fairly well developed, poorly nourished Mexican man of about the stated age of 48 years. There was a large swelling on the right side of the nose and right maxilla with an open wound on the right maxilla about an inch in length exuding purulent material. The tissues below the right eye were swollen and he had difficulty in opening the right eye. He had vision in the eye. The right side of the nose was entirely occluded by a neoplasm. There was tenderness over the area involved by the swelling. The tongue was clean and the palate of normal contour. The tonsils were small and imbedded. The superior portion of the anterior pillars was injected. The pharynx was normal. There was slight adenopathy.

The urinalysis and the blood Wassermann were negative. The erythrocytes were 3,900,000. The leukocytes were 12,400.

The radiologist reported an almost homogeneous density involving the right maxillary sinus, right nasal fossa and lower portion of the right orbit. He thought the floor of the right orbit had been destroyed by the neoplasm, indicating an invasion by a malignant tumor. The left maxillary sinus was cloudy. There was considerable calcification of the pineal gland. There was no Roentgen-ray evidence of pulmonary parenchymal, pleural or cardiac pathology.

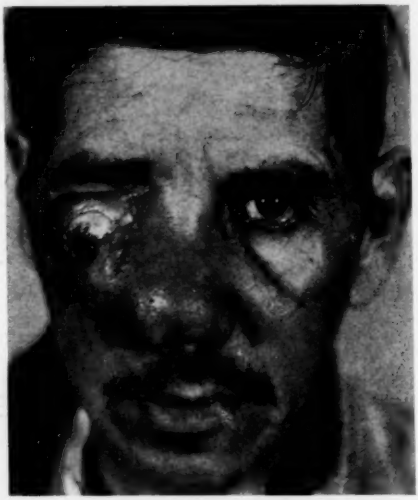

Fig. 13. Case 9: Photograph of Mexican with squamous-cell carcinoma of right maxillary sinus taken one week after admission.

On April 3, 1936, a biopsy specimen was taken from the right side of the nose and from under the skin of the right malar region. The bleeding was profuse and was controlled by the electric cautery. The final diagnosis was squamous-cell carcinoma of the right maxillary sinus.

On April 6, 1936, he was given a Roentgen-ray treatment. He was given three more treatments during the next three days.

Beginning on May 11, 1936, he received three more X-ray treatments over a period of three days.

On April 13, 1936, under local anesthesia, a large fungating mass was removed from the right side of the nose, so that an opening was made back to the posterior naris. The bleeding was profuse and was controlled by the electric cautery. The tissue was kept to be used as a culture medium for the B. histolyticus. He was given several treatments with the

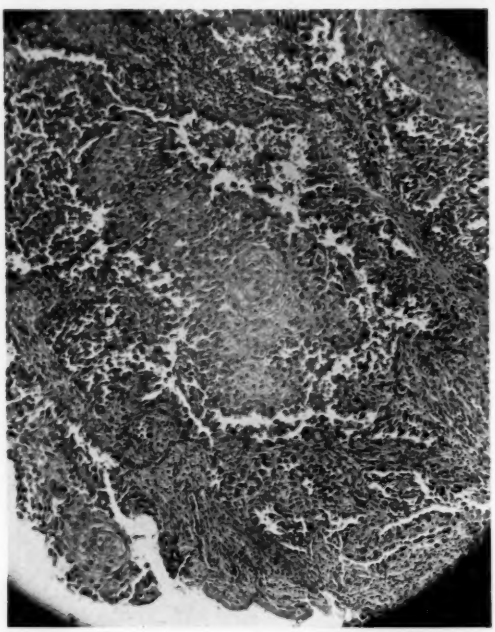

Fig. 14. Case 9: Squamous-cell carcinoma of right maxillary sinus magnified 75X.

ensol. He was discharged on leave as improved on May 28, 1936, to return in two months. He did not return. The social service department has not been able to trace him.

The biopsy specimen consisted of two pieces of tissue, one was part of a mass obstructing the right nostril, and the other was tissue removed through a previous skin incision over the zygomatic prominence of the right maxilla. Microscopically, these were made up of a typical squamous epithelium growing in broad sheets in a fibrous stroma. Epithelial

pearls were present, but were not well formed and retained single cell outlines. Keratohyalin granules were lacking. A large part of the tumor was composed of cells undifferentiated except for occasional spinous processes, with a tendency toward papillary arrangement. Mitotic figures were quite numerous. The tumor was a highly malignant squamous-cell carcinoma. The outcome of the case, following X-ray therapy, is not known.

Case 10: J. C., male, age 62 years, farmer, married, admitted Aug. 18, 1936, and discharged Nov. 12, 1936. The diagnosis on admission was malignancy of the right orbit.

His chief complaint on admission was of diplopia.

In March, 1936, the patient noticed a lump under the upper right eyelid. Ten day later the lump seemed to travel behind the eyeball and disappear. After several weeks he noticed the vision, O.D., became blurred and he had diplopia. He had lost weight since March, 1936. He believed his eyeball had been pushed forward. There was a sensation of throbbing in the orbit.

The general physical examination revealed a poorly developed white male of stated age. His skin was dry and freckled, with a few hypertrophic spots over each side of the neck. There was a blood clot in the right side of the nose. There was some exophthalmos on the right, with a little chemosis at the canthi. The pupils were equal and reacted to light and accommodation. The eye movements were normal. Several teeth were missing. There was much anterior cervical adenopathy. The thyroid was palpable, but not enlarged. There was some soft tissue retraction bilaterally in the supra- and infraclavicular regions. There was a small tumor mass in the left lumbar region. This was removed on Aug. 20, 1936. He had hyperkeratosis of the skin below each ear. These masses were removed Aug. 20, 1936.

The patient had diplopia on looking to the right, left or upward and nystagmus when he looked to either the right or left, but more marked to the left. The pupils and the fundi were normal. The movements of the face and tongue were normal. The hearing was normal for forks of low pitch. There was no disturbance of equilibrium and none of co-ordination. There was no tremor.

A Caldwell-Luc operation was performed on the right side under local anesthesia on Sept. 12, 1936. The mucosa was considerably thickened and polypoid. The roof of the sinus was composed of thin, eggshell-like bone intermixed with tissue which resembled granulation tissue, and which was believed to be carcinomatous from the orbit. This tissue and that from the sinus was sent to the laboratory. A large intranasal window was made in the right inferior meatus. The labiogingival incision was closed with silk sutures.

On Sept. 12, 1936, an incision was also made through the conjunctiva to the periosteum of the orbit. The periosteum was peeled back and bleeding controlled by pressure. A portion of the orbital contents was removed with a snare and the remaining portion dissected out. Along the floor of the orbit there was a mass of tissue which had eroded through the bony orbital floor. This mass involved practically the entire orbital floor, nasal and temporal walls. The mass was removed by electrocoagulation and curettage, so that a large opening was made from the orbit into the maxillary sinus. The area was electrocoagulated. An iodoform pack, saturated with mineral oil, was inserted into the sinus and through the roof into the orbit. Several silk sutures were used to close the canthotomy.

On Sept. 24, 1936, 45 mg. of radium were placed in the opening previously made in the orbital floor. Lead sheeting was placed over the surface of the eylids. This was left in place for 24 hours.

The radiologist reported there was no evidence of intrathoracic tumor invasion on Aug. 24, 1936. There was some accentuation of the aortic arch. The diaphragm and costophrenic angles were clear.

The urinalysis was negative on Aug. 18, 1936. The erythrocytes were 3,950,600 and the leukoyctes 6,600 on the same date. The spinal fluid Wassermann and the colloidal gold curve were negative.

The final diagnosis was squamous-cell carcinoma of the right maxillary sinus and orbit. His progress in the hospital was satisfactory. He is living and well.

Two tissue specimens were obtained; one from the antrum and the other from the floor of the orbit. Both were frag-

mentary masses of pink, soft tissue. Microscopically, in tissue from the antrum the lamina propria was occupied by large groups of clear polyhedral epithelial cells with numerous mitoses. Differentiation was lacking in these cells. The mucosa was intact, with many mucus-secreting cells in the pseudostratified columnar epithelium. The stroma was heavily infiltrated with lymphocytes and plasma cells.

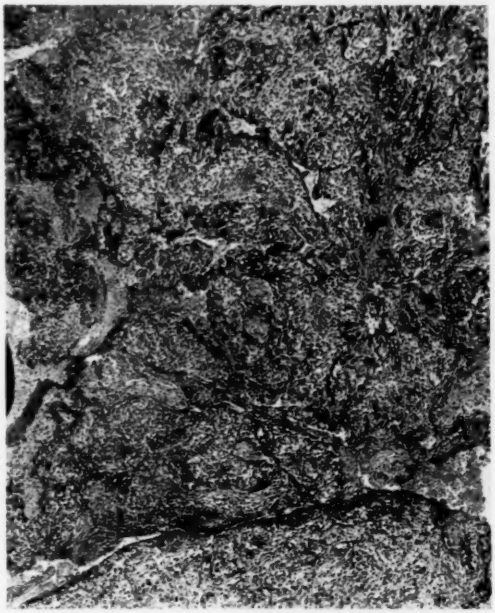

Fig. 15. Case 10: Squamous-cell carcinoma of right maxillary sinus and orbit magnified 75X.

In sections from the floor of the orbit the fibrous tissue was invaded by similar groups of cells in which an occasional epithelial pearl was present, and where spinous cytoplasmic processes were seen.

The diagnosis was squamous-cell carcinoma, probably primary in the orbit rather than in the antrum.

Case 11: W. F. A., age 67 years, white, male, married, retired, admitted Dec. 27, 1933, and discharged Jan. 24, 1934. The diagnosis on admission was deferred.

His chief complaint was of pain in the left side of his face with swelling. There was more or less constant headache, double vision and impaired hearing on the left.

One month before admission he noticed a small swelling at the corner of the left eye. The eyeball gradually became more prominent. He complained of some headache and a moderate amount of pain. The submaxillary gland enlargement had been coincident with tumor growth.

The physical examination showed a rather robust pyknic type of male lying quietly in bed. The left side of the face was swollen from what was apparently a superficial tumor mass. The left eyeball showed marked proptosis and conjunctivitis with increased lacrimation. There was some bloody discharge from the left side of the nose and the nose was enlarged on the left.

The skull was of normal contour, with some exostoses in the supraorbital portion of the left frontal region of the orbital foramen. The right pupil was somewhat irregular. It reacted slowly to light and accommodation. The right eye movements were normal. The left eyeball showed marked proptosis and the left pupil was smaller than the right. It reacted slowly to light and accommodation. The movements of the left eye were limited.

The right side of the nose was patent. There was no tumor. The left side of the nose was completely occluded by a fungating tumor mass which protruded well into the lumen. The external nose was distorted to the left by the tumor. There was no swelling or tenderness over the right sinuses, but there was on the left. The mouth was edentulous. The gums were in good condition. There was some bulging at the site of the former bicuspids and first molar above on the left. This area fluctuated slightly on pressure and was sensitive to palpation. The tongue was clean and protruded in the midline. There was a small tumor, about 2 or 3 cm. in size, projecting into the nasopharynx which could be seen with the postnasal mirror. The pharynx was slightly injected. The breath was foul. The tonsils were small. There was a slight anterior cervical lymph adenopathy palpable on the left, but not on the right. The submaxillary gland on the left was 4 or 5 cm. in size and sensitive to palpation.

The clinical diagnosis was probable malignant tumor of the left face, probably originating from the left ethmoidal cells and orbit.

On Dec. 30, 1933, tissue was removed from the tumor mass, protruding beneath the left inferior turbinate, and sent to the laboratory.

On Dec. 31, 1933, under local anesthesia, a small cervical gland was exposed and a biopsy taken for metastasis.

On Jan. 6, 1934, under ether anesthesia, a lateral rhinotomy, through the left cheek, was performed. A tumor mass was found to have broken through the anterior maxillary wall. The left maxillary sinus, ethmoid, and part of the sphenoid were completely filled with this tumor mass. The floor of the maxillary sinus was necrotic, but had not broken through the oral mucous membrane. All of the median wall of the orbit was destroyed by tumor tissue. Invasion of the pterygomaxillary fossa was evident. The nasoantral wall and all of the turbinates were removed and the tumor tissue in the maxillary sinus, ethmoidal cells and sphenoidal sinus exenterated. The cheek wound was left open for the insertion of radium.

On Jan. 5, 1934, the radiologist reported enlargement of the heart to the left, combined with some widening of the aortic arch. There was marked fibrosis in the hili and bronchial system. There was no evidence of pulmonary tumor metastases or of pleural effusion.

On Dec. 27, 1933, the urinalysis was negative. On the twenty-eighth the erythrocytes were 4,390,000 and the leukocytes 7,850. The blood Wassermann and Eagle tests were negative on Dec. 27, 1933.

The final diagnosis was rhabdomyoma of the left maxillary sinus, nose and orbit, which probably originated from the internal pterygoid muscle. Imperatori[10] has reported a case of rhabdomyoma of the larynx.

From Jan. 1 to 6, 1934, the patient received four treatments with deep Roentgen-rays.

On Jan. 10, 1934, 50 mg. of radium, protected by 2 mm. of lead and 1 mm. of brass, were implanted one-half inch

below the skin in the left maxillary sinus through the surgical incision. This was left in place 36 hours and reinserted in the ethmoid region for 24 hours. The eye was protected by an additional lead strip. The left maxillary sinus was washed a few times with saline or boric acid subsequent to the operation and before his discharge. His progress while in the hospital was quite satisfactory. He was discharged to the outpatient department as improved on Jan. 24, 1934. He received additional radiation subsequently. He did not do very well, however, and died in another hospital on May 10, 1934.

Fig. 16. Case 11: Photograph of patient taken a few days after admission with rhabdomyoma of left maxillary, ethmoid, sphenoid, orbit and nasopharynx.

Tissue specimens were removed from the nose and antrum, submaxillary gland and later from the antrum, sphenoidal and ethmoidal sinuses. All tumor tissue was firm, reddish externally, with solid yellowish white cut surfaces. Microscopically, an extremely bizarre growth was seen with essentially similar appearance in tissue from all sites. The tumor cells were large, oval or elongated, with abundant, often vacuolated acidophilic cytoplasm and angular reticular nuclei with prominent nucleoli. In an occasional cell cross striation resembling that of skeletal muscle was plainly seen. Mitoses

were rare. The tumor cells formed small, solid groups, separated by a network of connective tissue fibrils. The surface in many sections was covered by pseudostratified columnar epithelium. Extensive zones of hemorrhage and necrosis were present, with varying number of infiltrating leukocytes. Spicules of bone were present in some sections. Tissue from the submaxillary gland was almost completely necrotic, but a small zone containing tumor cells was found.

Fig. 17. Case 11: Photograph taken a few days after radical operation for rhabdomyoma of left maxillary, ethmoid, sphenoid, orbit and nasopharynx.

The tumor was a malignant rhabdomyoma, embryonal in type, but lacking other tissue elements which might be considered teratoid. For the most part the tumor cells lacked cross striations, but were acidophilic, and were similar to those in which cross striation of the cytoplasm was distinct.

The fact that the submaxillary gland was involved might suggest an origin as a mixed tumor, but as no evidence of teratoid elements was found in any location, it seems more reasonable to conclude that the primary site was antral.

Such tumors are of rare occurrence, most often in association with other constituents of mixed tumors. The genito-

urinary tract is the most frequent site. Other locations include the heart, testis, lung, breast, tongue, stomach and parotid.

The malignancy of rhabdomyoma is variable. Some are slow-growing encapsulated tumors, while others are highly malignant. This tumor was invasive, nonencapsulated, and appeared in all respects malignant.

Fig. 18. Case 11: Rhabdomyoma of left maxillary sinus, ethmoid, sphenoid, orbit and nasopharynx magnified 75X.

Pathology: The type of tumor in three of the cases is not known, as tissue for examination was not available, and biopsy reports are not on record. In the other eight cases a remarkably wide variety of tumors was found, including three unusual tumors.

Summary of histopathology: A series of 11 cases of tumors involving the nasopharynx and accessory sinuses included three tumors of undetermined type (no biopsy), one

transitional-cell carcinoma, four squamous-cell carcinomata, one neurosarcoma, one plasmacytoma, and one rhabdomyoma. The histological characteristics of these tumors are described.

Results: The "follow-up" shows that only two are living. One of the two has almost survived the five year period and the other has been under observation two years since his operation. Four are known to be dead. One of these was very advanced and inoperable at the time of admission. We have not been able to trace five of the patients.

Cooper[37] previously reported, in 1934, the cases of plasmacytoma and rhabdomyoma included in this series of 11 cases. With his permission the two cases are included.

Summary and conclusions: Earlier diagnosis, especially for intelligent private patients, early removal of the tumor by surgical diathermy, preceded on the operating table by a biopsy, the use of the cautery, radium and the Roentgen-ray have all helped to save human lives. Surgical removal of the superior maxilla is now rarely used. The death rate from this procedure, in the hands of our best otolaryngologists, has been quite high. Subsequent observation for any recurrence, with proper treatment for the growth, has also improved the results.

This group of 11 cases shows the variation in malignant tumors in a relatively small series. It also shows the necessity of a biopsy before any type of treatment is started, except in very late inoperable cases. The surgical, Roentgen-ray and radium treatment, cauterization, and surgical diathermy had to be used according to the type of tumor, as shown by the biopsy, and the extent of sinus as well as orbital involvement.

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VINCENT'S INFECTION OF THE MOUTH, THROAT AND LARYNX. REPORT OF A CASE.*

DR. A. J. WAGERS, Philadelphia.

Vincent's angina as commonly seen is neither of very frequent occurrence nor very serious, is easily diagnosed and in the average case responds readily to treatment; but when we see a case in which the local lesions are extensive and at first not only resist all treatment, but tend to spread and to so undermine the patient's vitality that life hangs by a thread, we believe such a case is worthy of bringing to your attention, particularly since the patient did recover.

G. C., a young man, age 17 years, was admitted to the medical ward of Jefferson Hospital on Oct. 7, 1935. He stated that his present trouble had begun two weeks previously with a slight cold in the head, followed by soreness of throat, gums, and tongue. A few days later, ulcers appeared on the tongue. About the same time he noticed a scab forming over the inner malleolus of the left ankle. He removed the scab, exposing a small amount of pus. During these two weeks he had lost 15 pounds in weight, was now extremely weak and the soreness in the throat had so increased that talking or swallowing caused considerable pain.

Past History: Patient had had usual diseases of childhood, had always been underweight, and had been under treatment for anemia for two years in the Children's Out-patient Department. Was admitted to the ward on Nov. 5, 1932, complaining of weakness, loss of weight, and jaundice. His tonsils had been removed before this time. He remained in the hospital about six weeks.

Physical examination on date of present admission: An emaciated young male, exhibiting a peculiar pallor and sallow appearance. No dyspnea, no jaundice, no cyanosis. Mouth: On the sides and under surface of the tongue there are some eight or ten small and one large ulcer. All the ulcers appear elevated above the surrounding surface of the tongue. A single fairly large ulcer is seen on the posterior wall of the oropharynx. No membrane seen. Neck: There is slight swelling in the region of the right submaxillary gland. No definite mass palpable—very tender. Trachea in midline. Thyroid not enlarged. Heart and lungs: Essentially negative. Temperature on admission, 100.6°. Pulse, 70. Respiration, 24.

Was this a case of agranulocytic angina, Vincent's infection, or tuberculosis? We turn to the laboratories for assistance. First, a blood count and report as follows: Hb. 60, R.B.C. 3,410,000, W.B.C. 8,100, C.I. .88, neutrophiles 63, young forms 15, eosinophiles 1, basophiles 0, lymphocytes 18, monocytes 3.

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It will be noted that there is no leucopenia present, which we would expect to find if the case were one of agranulocytic angina.

Blood Wassermann: Negative. Tests for typhosus and paratyphosus were negative. Blood culture: Negative after 48 hours. Urine: Normal.

X-ray report on chest: Patient has long, narrow type of chest. Pulmonary markings are considerably increased throughout both lungs. Some peribronchial thickening in right lower lobe. No positive evidence of tuberculous infection. Diaphragm smooth and regular. Heart of long, narrow type and a small normal.

Culture from ulcers on tongue: Streptococcus hemolyticus predominate. Occasional staphylococcus albus. A few diphtheroid bacilli seen. Culture from ulcer on ankle: Streptococcus hemolyticus and staphylococcus aureus. Smear from ulcers on tongue: Numerous Vincent's organisms.

From these reports it becomes evident that we have to deal with a mixed infection—Vincent's and streptococcic. It is my belief, however, that the illness began with the Vincent's infection and that the streptococcus hemolyticus infection appeared secondarily.

Treatment and Progress: Antiseptic mouth washes were employed. Local applications of neoarsphenamine in glycerin were made to the ulcers on tongue and pharynx. Balsam of Peru was applied to the ankle ulcer. Some slight improvement followed these applications.

One week after admission, several of the smaller ulcers on the tongue had nearly disappeared and the larger ulcers showed improvement. Ankle ulcer remained about the same.

Oct. 17: Ten days after admission all the small ulcers on the tongue have disappeared, but three large ulcers, two on the side of the tongue and one on the under surface, still remain. At this time the patient was put on liver extract, a 3 cc. ampoule being given intramuscularly twice weekly.

Oct. 19: A single application of 50 per cent silver nitrate was made to the tongue ulcers. The epiglottis at this time was found to be edematous and this swelling, combined with excessive coughing provoked by the attempt at examination, made it impossible to see the vocal cords. At this time the voice was weak, but there was no hoarseness.

Oct. 22: A few Vincent's organisms found in smear taken from pharyngeal ulcers.

Oct. 25: For the first time a satisfactory view of the interior of the larynx was had in spite of the swelling over the epiglottis and arytenoids. No ulcers were seen within the larynx and the vocal cords appeared fairly normal. The right side of the neck over the region of the larynx begins to feel indurated. Tongue lesions show no improvement; in fact, they are larger than they have been at any time. For the first time there is slight hoarseness. Temperature ranging from 100° to 102°.

Blood picture shows but little change. Hb. 52, R.B.C. 3,100,000, W.B.C. 6,300, C.I. .83.

Oct. 27: Patient's condition becoming gradually worse. Temperature remains elevated. Lesions on tongue are growing larger. Report from biopsy taken from one of these lesions showed it to be histologically only inflammatory tissue. Hoarseness continues and a herpetic eruption is seen on the scalp.

Oct. 28: Patient is very weak. Seen by Dr. Eads, who suggested small blood transfusions.

Oct. 29: Given blood transfusion of 300 cc.

Oct. 30: Aphonia now complete. Unable to see vocal cords on account of marked swelling of epiglottis and arytenoids. Many Vincent's organisms and streptococci seen in smear from pharyngeal ulcer. No acid fast bacilli. There is now seen a distinct ulcerated area on the right side of the hypopharynx involving the lateral wall and the pyriform fossa. A portion of this ulcer is covered by a blackish exudate, while the remaining portion is more grayish in color. The general appearance of the throat suggests the lesion seen in agranulocytic angina, but the W.B.C. is 9,600. Externally, the tissue of the neck overlying the ulcerated area feels infiltrated and is distinctly painful on pressure. The ulcerations on the tongue are slightly smoother in appearance. Temperature from 101° to 102°. On this day the intravenous administration of neoarsphenamine was begun, 0.2 gm. being given.

Nov. 4: Patient's general condition shows slight improvement. There is still considerable edema over epiglottis and arytenoids. No increase in swelling on right side of neck, but still tender on pressure. Blood: Hb. 64, R.B.C. 2,660,000, W.B.C. 7,800.

Nov. 5: Blood transfusion of 350 cc. Neoarsphenamine, 0.3 gm. intravenously.

Nov. 9: Condition improved. Patient feels better and is able to take more liquid nourishment. Ulcer on ankle improves very slowly. Throat still very sore. There is marked emaciation and a severe cough, with expectoration of a thick tenacious material. Specimen sent to laboratory showed neither Vincent's organisms nor acid fast bacilli.

Nov. 11: Definitely improving, but still aphonic. Tongue lesions are healing. No tenderness on either side of neck or tongue.

Nov. 18: Ulcers on tongue and lateral pharyngeal wall entirely healed. Patient able to eat solid food. There is still slight edema over arytenoids, but much less swelling and edema of the epiglottis. Patient allowed to be out of bed and sit in a chair for a short time. Temperature has been practically normal during the past ten days.

Nov. 23: In spite of the general improvement noted, we find for the first time a definite leukopenia, as will be seen from the following report: Hb. 59, R.B.C. 3,050,000, W.B.C. 2,500, C.I. .94, neutrophiles 22, eosinophiles 2, lymphocytes 69, monocytes 7. At this time the daily administration of 10 cc. Pentnucleotide was begun.

Nov. 27: The lowest recorded white cell count—1,900.

Dec. 2: Larynx shows marked improvement. Able to see vocal cords, which appear perfectly clear. The patient is still aphonic, but it appears now to be entirely functional. White blood cell count now 4,800.

Dec. 14: During the past 12 days the patient has been given three blood transfusions. The voice is returning.

Dec. 21: Patient was allowed to go home for the Christmas holiday. He returned on the twenty-sixth. At this time the mouth and throat were practically healed. The ulcer on the ankle had not yet healed and was now the principal object of attention.

Feb. 1, 1936: X-ray of lungs suggests early bronchiectasis.

Feb. 15: Blood count: Hb. 87, R.B.C. 5,050,000, W.B.C. 13,700, C.I. .87.

Feb. 18: I was asked to see this patient again. Examination disclosed the presence of two small ulcerated areas on the right side of the tongue. They were very superficial and appeared to be of the same character as those seen originally. There were also two shallow ulcers on the post pharyngeal wall. The larynx was free from ulceration or swelling. The epiglottis had healed, but was somewhat narrowed at the tip from sloughing. Under local applications of argyrol, 10 per cent, the tongue and pharyngeal ulcers gradually healed. The patient's general condition continued to improve and he was finally discharged from the ward on April 9, 1936, but visited the out-patient department for treatment of the ankle ulcer for several weeks before it finally healed.

SUMMARY OF INTERESTING POINTS IN THIS CASE.

A period of more than five months elapsed between onset of illness and final eradication of mouth and throat infection.

Most critical stage of disease not reached until between four and five weeks after onset.

Leukopenia appeared long after general and local condition had improved.

The prompt and undoubted value of neoarsphenamine, given intravenously, in overcoming the Vincent's infection.

The supportive value of blood transfusions during and after the period of the most devastating effects of the disease.

Finally, the very favorable response of the leukopenia to pentnucleotide.

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RATIONALE AND TREATMENT OF SIGMOID SINUS INFLAMMATION.

DR. E. R. HARGETT, Washington, D. C.

The following case is cited to introduce and illustrate problems dealt with in this article:

D. W., male, age 37 years, admitted Aug. 14, 1937; card No. 7946. During a fight, two months before admission, patient received a blow on the nose which caused it to swell shut for several days, during which time it remained painful, and his face and left ear became painful. He did not go to a doctor; the edema of the nose subsided, with no deformity; however, he began to have a purulent discharge from the left side of the nose and pain in the left cheek. The earache became worse, and about a month after the original injury, the drum ruptured and began to discharge pus. The pain in his face subsided somewhat, but his ear became worse and, about two weeks before admission, became painful over the mastoid region. Two days before admission, the area over the mastoid began to swell and became extremely tender.

He was admitted with diagnosis of acute mastoid, subperiosteal abscess and chronic sinusitis. Temperature 98.6°, going up to 100° on the second day. Pulse, 78; resp. 18, dropping to pulse 64, resp. 20 on the second day. Hg. 59 per cent, reds 3,290,000, whites 6,800, 56 per cent polys. Faint trace of albumin in urine.

X-rays of sinuses read: "All sinuses exceptionally large. There is marked cloudiness of both antra, worse on the left. The ethmoid and sphenoid sinuses are moderately cloudy. Diagnosis: Old chronic sinus infection, worse in the left antrum." Mastoid: "The left mastoid is definitely cloudy. There are no normal cells remaining, and one area in the center of the mastoid area suggests abscess. The right mastoid is clear."

Hot applications, irrigations, nasal shrinkages, prontylin 10 gr. every three hours, and rest in bed, with the usual hospital routine, failed during two and one-half days to relieve the pain or reduce the swelling, and a simple mastoid was performed.

Operation No. 79972, Aug. 17, 1937: A large subperiosteal abscess was entered just beneath the skin, having eroded an opening in the outer wall of the mastoid about 1 cm. across. Upon enlarging this it was found that many of the cells were broken down, all were filled with pus, and the bony plate of the knee of the sigmoid sinus had been eroded away, leaving an area about 1 by 1½ cm., filled in with granulation tissue, exposed. The mastoid was completed, the antrum being more than usually enlarged and the granulation tissue removed from the sinus, and a small perforation made in it. This bled freely, and was packed with an iodoform roll, to which a heavy black silk thread had been tied, the end of the latter being left outside the wound in order to remove the roll. The remaining mastoid cavity was packed with a separate strip of iodoform, and the wound closed except for the lower end, left open for drainage.

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The next day the temperature reached 100.8°, then rapidly dropped to normal, where it remained until the sixth day, at that time going up to 101.8°. The sinus pack had been loosened some each day, and completely removed on the fifth day. The other packing was taken out the day following operation.

Thus, on the sixth day, temperature 101.8°, pulse 80, respiration 20, we have the patient complaining of severe pain over the site of operation, extending over the whole left side of the head. There was nothing to suggest a chill, the ophthalmological examination was entirely negative as regards the problem; there was no vomiting. The white count was 17,000. Blood culture was negative. A tentative diagnosis of sinus phlebitis was made, in spite of the absence of chill. Prontylin gr. X, T.I.D., was begun on the third day, more as a precautionary measure, considering the widespread nature of the infection, and the fact that the sinus was entered. We believe that this drug altered the symptoms as described above, and prevented the manifestation of the chill typical of sinus phlebitis.

The temperature spiked between 101.8° and 98° for five days, the peaks becoming about one-half degree lower each day. The treatment was conservative, prontylin being continued as above. Following the principles of treatment in phlebitis of veins of the leg, the head was slightly elevated, heat was applied to the affected side, and the head was immobilized with sand bags and pillows; the patient was carefully watched, no head movement being allowed, fed liquids by the nurse, and absolute bed rest technique was carried out. The temperature and pain accompanying it subsided in the eleventh day, and the former remained within normal limits. Treatment was relaxed, and drugs stopped, but bed rest continued until fifteenth day, when the patient was allowed bath privileges. A few hours after he had taken advantage of these privileges, the temperature went up to 100° and the pain in the side affected returned, being of a throbbing nature. Treatment was resumed, and in two days, symptoms and temperature subsided. He was kept at bed rest until the twenty-third day, when privileges were again granted. The same symptoms immediately returned, this time the temperature going up to 102°. In two days' treatment, normality was again restored. He was kept in bed until the forty-fifth day; two days of activity produced no symptoms, and he was discharged in good condition.

Thus the case serves as an introduction to our form of treatment and theory of sigmoid sinus phlebitis, thrombosis, and embolism. The basis of this is that these conditions should be considered as identical entities with venous inflammation in other parts of the body, notably the leg, where they are most frequent. After thorough curettement of the infected mastoid and its angles, and adequate drainage of the wound, it may be disregarded and the venous inflammation treated. Prontylin serves to decrease the severity of the inflammation, but even a prior course of the drug fails to prevent it; the drug also has a tendency to mask the typical symptoms of the complication.

Simple phlebitis, with its moderate fever, usually not higher than 102.5°, with little or no chill, will respond to immobilization of the head, heat, prontylin, and absolute bed

rest technique, with liquid feeding to prevent chewing, and slight elevation of the head of the bed to prevent pressure on the sinus. As with phlebitis of the leg, the patient is not safe from a recurrence for about six weeks. However, the condition may rapidly go on to sinus thrombosis.

Sinus thrombosis is characterized by a real chill, a higher temperature, and more marked systemic symptoms, with a greater amount of pain in the affected area. The above measures do not suffice, and added rest must be given the venous tract by ligation, thereby preventing it from being acted upon by the pressures, pulsations, and other physical forces of blood flow. Ligation then puts the area at absolute rest, and with the other measures still in force to insure it, most cases subside to cure in the usual period of six weeks or less; however, the case may be seen late, or in spite of the above treatment, may go on to the third and last stage, sinus thrombosis with embolism. This is a purulent condition in the sigmoid and nearby veins, manifested by foci of infection in other parts of the body.

All the above principles of treatment apply, up to and including ligation of the internal jugular vein. In addition, the sinus should be opened, the bony plate being taken off as far up the lateral sinus towards the torcular herophili as the clot or thrombosis extends, and the jugular bulb sucked out with the rubber suction tube, according to the best surgical technique (Jackson-Coates). The foci already set up may then be treated by repeated small transfusions. The principles of rest to the affected areas must continue to apply.

CONCLUSIONS.

1. General principles of the treatment and theory of venous inflammation are applicable to inflammation of the sigmoid sinus and its connecting veins.

2. Prontylin given early in sigmoid sinus inflammation, or before its occurrence, moderates the condition and tends to mask the typical symptoms, but does not affect the recurrence period.

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HEARING DEFICIENCIES IN RELATION TO SPEECH DEFECTS.

DR. HORACE NEWHART, Minneapolis.

From a recent contribution by your president, I quote the following impressive figures: "Among the 50,000,000 children of school age in the United States are 40,000 blind, 60,000 totally deaf, 80,000 partially sighted, 3,000,000 hard of hearing, and 4,000,000 defective in speech."

Since articulate speech is normally acquired by imitation through hearing, vision and touch (hearing being by far the most essential), the last two quoted figures forcibly indicate the fact that subnormal hearing causes a very substantial proportion of speech defects. None can be more conscious of this fact than you, the members of this group; the public, including our legislators, have failed largely to grasp this thought.

Notable advances in electro-acoustics during recent years have resulted in outstanding progress in otology. The development of the audiometer has provided greatly improved, standardized means for accurately measuring hearing acuity; has made possible valuable research in ear physiology and pathology, and has contributed to rapid improvement in the performance characteristics of electric hearing aids.

It is our purpose to present briefly from the otologist's point of view some of these newer facts as related to speech defects.

Extensive use of audiometers, particularly among school children, has disclosed an amazingly high incidence of hearing deficiency which has been overlooked by the methods previously available; in fact, the new methods of testing the hearing have been shown to be from four to five times as accurate as our older methods. This revelation has emphasized the importance of periodically checking the hearing of

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all children, including those of pre-school age, to disclose a significant hearing loss. For our purpose we would define broadly a significant hearing loss as any deficiency of hearing acuity which constitutes an existing or potential interference with the normal acquisition of articulate speech, average educational advancement and reasonable achievement with respect to one's economic and social life. It should be noted that among school children a relatively slight hearing defi-

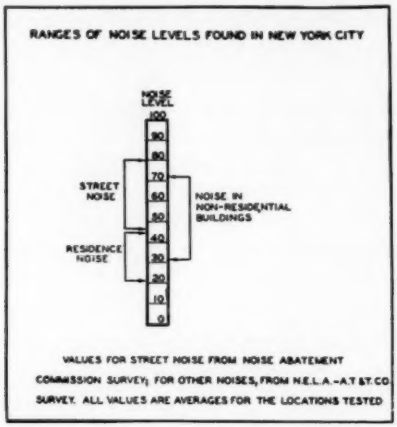

Fig. 1. From City Noise. Report of Noise Abatement Commission, Department of Health, New York City.

ciency may constitute a significant loss. The early discovery of such a deficiency is of great importance, since it may be the only indication of a beginning handicapping deafness.

We have only recently learned the important principle that no hearing test can be accurate for the detection of a slight hearing impairment when made in the presence of any distracting or interfering noises such as those which are ordinarily present in the average office or school building in a city. Besides distracting the attention of the person being tested, the noises mask the sounds used for testing. The noise levels encountered are well shown in Fig. 1, from the report of the New York Noise Abatement Commission of 1930. For accuracy in making hearing tests, the noises must be reduced to a practical working level by modern acoustic treatment, both in medical offices and school buildings.

Our time-honored methods for testing the hearing by watch-tick, acoumeter, whisper and conversational voice as ordinarily applied have proved too crude, inaccurate and time-consuming for the requirements of modern otologic practice. The futility of depending upon the use of the loud whisper and conversational voice for detecting slight hearing loss is well illustrated by Table I from Dr. Harvey Fletcher's "Speech and Hearing." It shows the maximum distances in a quiet place, free from reflections, at which called numbers are interpreted by persons having various amounts of hearing loss.

TABLE I.

MAXIMUM DISTANCES IN A QUIET PLACE FREE FROM REFLECTIONS FOR INTERPRETING CALLED NUMBERS BY PERSONS HAVING VARIOUS AMOUNTS OF HEARING LOSS.

Hearing Loss in Sensation Units (dcb)	Average Whisper	Loud Whisper or pp Voice	mf Voice	ff Voice
0	39.5 ft.	222 ft.	1250 ft.	1½ mi.
5	22.2 ft.	125 ft.	704 ft.	3950 ft.
10	12.5 ft.	70 ft.	395 ft.	2220 ft.
15	7.0 ft.	39.5 ft.	222 ft.	1250 ft.
20	4.0 ft.	22.2 ft.	125 ft.	704 ft.
25	2.2 ft.	12.5 ft.	70 ft.	395 ft.
30	15.0 in.	7.0 ft.	39.5 ft.	222 ft.
35	8.5 in.	4.0 ft.	22.2 ft.	125 ft.
40	4.7 in.	2.2 ft.	12.5 ft.	70 ft.
45	2.7 in.	15.0 in.	7.0 ft.	39.5 ft.
50	1.5 in	8.5 in.	4.0 ft.	22.2 ft.
55	.8 in.	4.7 in.	2.2 ft.	12.5 ft.
60	.....	2.7 in.	15.0 in.	7.0 ft.
65	.....	1.5 in.	8.5 in.	4.0 ft.
70	.....	.8 in.	4.7 in.	2.2 ft.
75	.....	.....	2.7 in.	15.0 in.
80	.....	.....	1.5 in.	8.5 in.
85	.....	.....	.8 in.	4.7 in.
90	.....	.....	.....	2.7 in.
95	.....	.....	.....	1.5 in.
100	.....	.....	.....	.8 in.
110	.....	May be reached by speaking tube		
115	.....			
120	.....	Totally deaf		

In any hearing test each ear must be tested separately. A common source of error in making hearing tests is failure to exclude or mask effectively the better ear if its acuity is much greater than that of its mate. We would point out the fact that merely closing the canal of the other ear with the finger is not sufficient when testing the worse with sounds louder than the suppressed whisper and the watch. Special masking methods are used when testing with louder sounds.

A test of the relative hearing acuity for both air and bone conduction is recognized today as essential for diagnosis and treatment and for determining the type of hearing aid best suited to the needs of a person with a severe hearing loss. For this purpose, tuning forks when calibrated and carefully used are valuable, but the audiometer with both bone and air conduction receivers serves the same purpose with greater accuracy and a saving of time and patience.

Man is generously endowed by nature with a hearing acuity materially in excess of his requirements for the ordinary contacts of civilized life. This physiological factor of safety makes it possible for an individual to lose a very considerable amount of hearing acuity without being aware of the deficiency or without its detection by others. This often leads to long neglect of chronic and recurrent ear affections resulting in some cases in irreparable hearing impairment and speech defects.

Today, as a result of extensive tests by modern methods, we know that even a slight hearing loss may cause in the school-child retardation, speech defects, an inferiority complex and behavior problems. The real cause of these conditions is frequently unsuspected by both parents and teachers. Retardation occurs more than three times as often in aurally defective children as among those with normal hearing. Dr. G. Oscar Russell has shown that the incidence of speech defects is eight times as great among those with a hearing loss as among normal hearing persons of the same age. We have found that hearing deficiencies occur among rural school children with much greater frequency than among city children who have the benefit of better school health service. These findings indicate the urgent need of extending the school health program to include accurate hearing tests of rural school children.

Legislation effectively providing for modern hearing tests of all school children and for instruction in speech reading and speech correction have been passed recently in New York and Pennsylvania. In California and Oklahoma, laws have been enacted to meet the needs of the hard of hearing and the speech defective child. In other states bills having a similar purpose are under consideration.

That even a slight hearing impairment causes speech defects such as omissions, substitutions and transpositions of consonants and, to a lesser degree of vowels, is clearly indicated by Table II, also from Fletcher. This shows the relative phonetic powers of the fundamental speech sounds.

TABLE II.

RELATIVE PHONETIC POWERS OF THE FUNDAMENTAL SPEECH SOUNDS AS PRODUCED BY AN AVERAGE SPEAKER.

ȯ (haul)	680	ū (rule)	310	ch (church)	42	K	13
a (father)	600	i (tin)	260	n	36	v	12
e (but)	510	ō (greet)	220	j (judge)	23	th (this)	11
ȧ (fat)	490	r	210	zh (azure)	20	b	7
ō (go)	470	l	100	z (haze)	18	d	7
u (full)	460	sh (ship)	80	s (ace)	16	p	5
ā (fane)	370	ng	73	t	15	f	5
e (get)	350	m	52	g (go)	15	th (thin)	1

Unless the young child correctly hears the less dynamic elementary speech units he cannot correctly repeat them. Thus, a child having a relatively slight hearing loss early in life often suffers greater speech distortion than a child having a much greater loss later in life.

It is the general belief that hearing deficiency is not a cause of stuttering. We would suggest that further study of the subject by modern methods may disclose the fact that the emotional disturbances resulting from frustration, anxiety and fatigue incident to prolonged effort to hear may bear some causal relation to stuttering.

From an otological standpoint the most important factor to be considered with respect to hearing in relation to defects of speech is the early discovery and prompt correction, if possible, of an existing or potential hearing deficiency. It is relatively easy to disclose a profound deafness in the infant or young child by observation and by the cochleopalpebral test and conditioned response methods. It is more difficult, however, to determine accurately the degree of loss.

The instrument most widely used in screening school children to disclose hearing defects is the 4-A or phonograph audiometer, recently superseded by the 4-B instrument. Its use offers the advantages of much greater accuracy and economy of time than the older methods. Groups numbering up to

40 persons are tested simultaneously, provided they can write to dictation. Children of kindergarten age and those of the first two grades and the blind are tested in smaller groups by the same instrument with the assistance of older persons who write the numbers heard and whispered by the children.

The disadvantages of this instrument are its initial cost and its limited intensity range. It is not an instrument of precision and thus is not suitable for diagnostic purposes. It does not reveal deficiencies for the higher frequencies which are necessary for the perception of consonant sounds. Its usefulness for the rapid, economical screening of large groups, when used strictly according to the operating instructions, is unquestioned.

Apparent discrepancies in the data obtained by its use in different communities are not entirely avoidable. They are due largely to faulty methods of application, including disregard of the noise level, failure to adopt a uniform standard for differentiating between children having a significant deficiency from those with normal or practically normal hearing, and to the lack of a standard method of grading the test papers.

On the basis of the medical history recorded at the time of making the tests, and the audiometer findings, as confirmed by the 2-A audiometer or a similar instrument, children found to have a significant loss are recommended for medical and otological examination.

As the result of extensive clinical observation it is known that a large percentage of all cases of acquired deafness are preventable by early discovery and prompt corrective treatment; also that many cases of a serious hearing handicap first noticed in adult life are traceable to upper respiratory infections in childhood.

There has long prevailed among the laity and many physicians, a deep-seated, cruel defeatist or do nothing attitude toward diseases of the ear resulting in progressive hearing loss, regardless of the type or cause. In the light of increasing otologic knowledge this dangerous fallacy is giving way to the more reasonable view which demands that all possible causes of increasing hearing impairment, be they local, general or occupational, be discovered early and be promptly

removed or avoided. Research has shown that many disorders of the ear producing defective hearing are caused by disease or disturbed function in parts of the body other than the ear itself, a new thought, even to some physicians, which should be given wide publicity.

A large number of adventitiously deafened individuals, both children and adults, possess some usable residual hearing power. In residential and day schools for the deaf the hearing loss of one-third of the pupils is such that when supplemented by a modern hearing aid and acquired skill in lip-reading, or visual hearing, this remnant of hearing becomes a priceless asset in learning and retaining correct speech and in fitting the individual for life's contacts and responsibilities.

It is especially important that the pupils in school for the deaf be protected from upper respiratory infections and contagious diseases which often cause further hearing loss. In many residential schools for the deaf the facilities for isolation are very inadequate.

Because the conservation of residual hearing is often a question of preserving one's general health, hard of hearing persons at all ages should have the guidance of a qualified physician or otologist who is seriously interested in their hearing problems.

Great improvements in electric hearing aids are being made with surprising rapidity. It behooves all who are actively interested in speech correction and in the amelioration of the condition of the hard of hearing to keep informed as to progress in this department of electro-acoustics.

Among recent advances in this field the most important is the development of selective amplification, by which the component units of a portable carbon microphone hearing device, of variable amplifying power at different pitches, are assembled in such combination as will best meet the special requirements of the individual as shown by his audiogram. Thus, the most commonly used hearing aid is given a wider range of usefulness among persons previously unable to be helped by this type of hearing device. In selected cases these wearable individual aids should be more generally prescribed for children with a handicapping hearing loss for home and school use.

Many persons having a severely handicapping deafness involving especially the higher frequencies cannot be helped by the usual carbon microphone type of hearing aid. These individuals find the greatest satisfaction in the use of vacuum tube instruments with their greater amplification and fidelity in reproducing speech. These instruments are being greatly reduced in size and weight, making them more wearable. Vacuum tube outfits with multiple head phones are being used to great advantage in many schools for the deaf for group instruction and speech correction. Lack of funds prevents their universal adoption.

In closing, we would reiterate that during the past few years very significant advances have been made in electro-acoustics and in otologic practice which should be helpful in advancing the science of speech correction.

The following conclusions seem to be warranted:

1. Every speech-defective child should be given a hearing test, preferably with a 2-A audiometer or its equivalent.

2. Every speech correctionist should have a satisfactory course in the fundamental principles of testing the hearing, with special reference to its relation to speech. Such courses already are being given in certain institutions.

3. Speech departments in universities and teachers colleges should emphasize the importance of early correction of speech of hard of hearing children.

4. Every speech department should encourage the establishment of lipreading and the making of regular, periodic hearing tests as an important feature of the educational program of its respective state.

5. The realization of these ideal provisions can be accomplished only through an effective campaign of education among physicians, educators and parents. By closer cooperation of speech pathologists and otologists we may expect an earlier attainment of this double goal—conservation of speech and conservation of hearing.

527 Medical Arts Building.

THE FACTS AND FALLACIES OF HEARING TESTS.*

DR. WALTER A. WELLS, Washington, D. C.

Hearing tests are done for two distinct purposes: *1.* To simply measure the acuity of the hearing, and *2.* to diagnose the cause or location of auditory disease.

Both are important objectives, because a loss of an appreciable degree of hearing is of serious concern to every individual, and a severe loss is likely to have profound bearing upon his social and economic life.

Acuity hearing tests are therefore valuable to discover an early loss of this function, and diagnostic tests are essential to determine cause and location of the trouble, so that helpful treatment may be timely instituted.

Unfortunately, however, hearing tests for both these purposes are greatly neglected, and they are only exceptionally undertaken with the care, precision and scientific accuracy which their importance demands.

By way of introduction, let us sketch a picture, which we believe not to be an unusual one in actual life.

The scene is a doctor's office in a large city. The time is midsummer. It is a warm day, and the window is slightly open to allow a little cool air for our doctor and his patient.

At the far end of the room, his back against the wall and his elbow upon a table by his side, sits the patient, who has come to have his hearing tested.

The doctor, having placed a pledget of cotton in one ear of the patient, stands facing him, and repeats in a conversational voice, and then in a whisper a series of numbers to test the ear which is not excluded. As soon as the patient gets each number spoken, the doctor steps backward until the words are no longer, or just barely heard. He then changes the cotton to the other ear and repeats the test, and

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then notes the distance in feet, which he sets down as his record of the voice test for each ear.

What is wrong with this picture?

1. In the average doctor's office in a large city, even with windows closed, there is an average noise of about 25 dcb., which cuts down normal hearing about 15 per cent, and makes it impossible to discover slight hearing impairment; with window partly open on this warm midsummer day, as in our picture, the decibel rate is raised to 40 or 50 dcb., so that with the rise and fall with passing traffic, there will be such interference and such fluctuation that the tests are worthless. Let us suppose, then, that the doctor, despite the discomfort, closes the window and proceeds with the examination. The noise will be reduced, but is still too much for accurate tests.

2. The room is much too small. The ordinary conversation in a quiet room can be heard by a normal ear 60 feet; even the standard whisper 20 feet. Therefore, for tests of this kind a room of extraordinary size is required.

3. Spoken words, whether tonal or whispered, differ in intensity at different times and with different persons. For correct hearing tests a fixed standard of intensity is essential. You may make some approach in standardizing the whisper by only uttering your test words after a complete expiration, using residual air.

4. The patient should not be leaning against the wall, nor have his arm on the table, for vibrations are thus conducted, interfering with the delicacy of the tests.

5. There is an error in assuming that cotton in one ear excludes that ear for ordinary conversational voice or whisper in an average size office room. Most watches, as you can easily prove, are clearly heard through cotton at a number of inches from the ear, according to the loudness of the watch; but less if cotton is previously moistened, and the tragus pushed firmly inward. As you know, one of the simplest tests for simulation of unilateral deafness is to stuff the good ear with cotton and approach the alleged deaf one with a loud-ticking watch. The malingering patient refuses to hear it, when, as a matter of fact, he should hear right through the cotton of the good ear.

6. The doctor is facing the patient in making his test. This is a glaring fault, for a good lip reader will easily catch every word without hearing; and even one with no training in the art is apt, unconsciously, to be helped by watching the movement of the lips and facial expression.

7. The physician, when his words are well heard, gradually increases the distance. The fault in this is that the sounds linger in the memory and the patient imagines he still hears what he actually does not. It is better, after having given the patient a sample of what he must listen for, to approach from no hearing to hearing.

8. The use of a series of numbers, first spoken and then whispered, is open to the criticism that different numbers are easily guessed when so repeated and the subject knows that you are using them.

9. Words differ in frequency quality as well as intensity, which makes the test unequal.

Sibilant sounding numbers, as six and seven, have a much higher pitch than that predominant in such numbers as four or forty.

Such an examination as here depicted is often made in good faith for the determination of a patient's acuity of hearing. We call your attention in this case to nine evident fallacies. Outside of these, the picture is, we trust, nearly all right.

Incidentally, great care must be used to avoid accentuating certain words. A clever subject can guess much from the accent of words and the context of a sentence.

No matter under what condition and with what precaution hearing tests are made, there is one source of error, which is common to them all and difficult to avoid, and yet which examiners take too little into account. I refer to the human element.

Hearing is a subjective sensation which cannot be objectively measured, and consequently we are in the final analysis absolutely dependent upon the responses of the subject. Any physician of experience knows how undependable and often misleading patients may be in the interpretation of their own sensations.

Our hearing tests are based on minimal or threshold sensation, which is no easy task for even the most intelligent and alert to sometimes distinguish. When you are dealing with a stupid, lazy or inattentive person, the answer will often be very wide of the mark.

In all hearing tests due allowance must be made for fatigue phenomena, quite pronounced in some cases. A sound too long continued completely fades, due to fatigue of the nerve. A proof that it is fatigue is that if the sound stimulant after failing is removed for a few seconds and then brought back to ear, the sensation returns. The psychological fact of memory images has already been mentioned.

As otologists, we are particularly interested in the application of hearing tests for diagnostic purpose. To locate the seat of the trouble special tests, variously modified, have been devised.

They are all based on certain fundamentals, which are, *viz:* *a.* that in conductive deafness the low notes are especially involved and there is apparently prolonged bone conduction; *b.* in the case of inner ear deafness, high notes are found to be especially affected and there is shortened bone conduction. But even these fundamentals have been recently challenged.

Our lifelong belief that bone conduction is prolonged in conductive deafness is a fallacy, due to the fact that these tests have hitherto all been made in a somewhat noisy environment. A conductive lesion serves to exclude the outside noise, and the intact inner ear thus protected gets the full benefit of the bone conducted sound and therefore there is an apparent prolongation as compared to normal, because the normal ears are subject to the masking effect of the outside noise.

Knudsen and Jones, of Los Angeles, made careful studies of a great number of these middle ear cases with supposed prolonged bone conduction and discovered that when the tests were made in sound-proof rooms, the prolongation did not exist. Our conclusion from these studies must be that in the use of the old bone conduction tests for the discovery of middle ear disease, we must adhere to the old method of using them in a noisy environment.

One of the other fundamentals in qualitative tests has recently also been challenged, at least in its practical impli-

cation. Harvey Fletcher, referring to the tests of high and low notes for the differentiation of middle and internal ear disease, warns that too much confidence should not be placed in our results because of the wide variation that may normally occur in the two extremes of the scale. Exceptional findings, however, must not be allowed to stand in the way of a good general rule.

Let us now briefly consider the three well-known tuning fork tests, the Weber, the Rinné, and the Schwabach. In the use of the tuning fork many errors may creep in:

1. It has long been realized that there is a serious defect in all tuning fork tests due to the difficulty in standardizing the initial blow. A spring hammer fixed to one prong may be used. Letting the fork fall of its own might was suggested by Randall. These devices, however, serve only as a crude approach to assuring a definite intensity.

2. Tuning forks have overtones, which interfere much with the result, especially if struck too hard a blow. It is best to strike gently and at junction of middle and outer third—the acoustic centre.

3. Different results will be obtained according to the manner and degree of pressure of the stem against the skull. Anyone can easily prove for himself how much he can at will lessen or increase sound, using now light, now firm, pressure on the stem. Furthermore, see that stem contacts the scalp and not a thick cushion of hair.

4. The manner of grasping fork is also important. One must avoid a tight grasp to prevent damping vibrations.

5. In tuning fork tests the fatigue phenomena is especially prone to occur. It is best avoided by alternate periods of rest and stimulation.

The *Weber test* is made by placing the stem of a vibrating tuning fork on midline of the skull. In case of deafness of one ear, it will be lateralized to the deaf ear if the trouble is in the middle ear, but to the good ear if the trouble is in the labyrinth.

In a simple uncomplicated unilateral deafness this may hold, but if, as often happens, there is trouble in both ears, or it is of mixed type, as may be the case, the result is undependable, even misleading.

The regular reaction, moreover, may in any case be altered by asymmetry of the skull or abnormal resonance, producing results contrary to expectations.

McKenzie has called attention to the frequent absence of a lateralization to the affected side in mastoiditis, even when apparently prolonged on that side—so-called "Weber-Schwabach paradox."

The *Rinné* test is for the purpose of comparing bone and air conduction in the same ear. It is generally made by holding the stem of the vibrating fork against the mastoid until no longer heard, and then quickly changing and holding the prongs close to the meatus.

As a basis of comparison, it is stated that for the normal ear air conduction is about twice as long as bone conduction. But this will vary with difference in the pitch of the fork, also distance of prongs from meatus, and degree of pressure against the bone. It will also differ according to whether you first test air or bone, because if bone is first tested, damping comes into play.

In deafness of the conductive type, bone conduction is relatively lengthened; so much so that in a severe conductive deafness, the relation is reversed, and it is of longer duration than by air—Rinné negative.

But there is danger in a too sweeping generalization. Every negative Rinné does not justify a conclusion of conductive or middle ear deafness.

We often get a negative Rinné in a severe nerve deafness, both air and bone conduction being shortened, the air more so than the bone.

In a case of complete deafness due to nerve, you can have a false Rinné; no hearing at all by air, but some by bone, sound being transmitted from the opposite side.

The *Schwabach* test aims to determine the actual duration of bone conduction and to compare it with the normal.

We have already referred to the fallacies incident to this procedure, due to differences in noise of room, in distance from ear, pressure against the bone, manner of holding stem, fatigue phenomena, etc.

At best it seems to us an uncertain as well as tedious procedure. We believe that the simplified procedure of comparing patient's bone conduction with that of the examiner previously determined gives as satisfactory information as counting the seconds, and it takes much less time.

My objection to using the Schwabach procedure with forks of different pitch in order to get a curve is that the forks of a pitch above 2,048 are not suitable for bone conduction tests, and it is only forks higher than this that give the information we need in regard to the upper end of the scale.

Now a word as to the audiometer: This instrument is somewhat costly and it is not perfect, but it is, even so, so far superior to the older methods that no one who wishes to do scientific work can afford to be without it, at least for testing hearing acuity.

It is a scientific instrument because it measures with mathematical exactness the energies that are in known relation with the sensation of hearing, and thus gives us a much needed standard of determined intensities.

It has at the same time the advantage of enabling us to make a graphic record, important for comparison for future times or with other observers.

It makes no great difference that audiometers of different types are on the market, and that charts of different types are used.

The sensation unit used in some types corresponds with the decibel used in others, and the decibel has become the accepted scientific standard of sound intensities. In some types of audiometers the hearing is charted in percentage values, because it is more readily grasped by the average person.

Another advantage of the audiometer over the old method of tests by voice, watch, etc., is in the use of the earpiece which enables the patient to listen with either ear separately without interference of the other side.

Observe that we are speaking of the value of the audiometer for testing hearing acuity. Its value for diagnostic purpose, though claimed by some, is still a debatable question.

It is proper that we mention, too, certain fallacies into which one may be led if not on guard in the use of this instrument. The use of the ear phone does not insure absolutely pure air conduction hearing. There is always a certain percentage of osteotympanic conduction in every such test.

Observers have noted that in case of complete unilateral deafness they may get a curve which exactly parallels that of the good ear at a depth 30 or 40 dcb. below it. This is spoken of as a shadow curve, being a reflection of the hearing from the good side. It can be abolished by proper masking of the ear not being examined.

Masking is always in order if perfectly dependable results are to be had in the separate testing of the two ears.

This is particularly true in testing by bone conduction.

The Schwabach test, therefore, which purports to give bone conduction values, cannot be relied upon for the bad ear if the other ear is normal or nearly so, unless the masking procedure is employed.

Now, finally, we must mention again and emphasize the fallacy of testing hearing acuity in a noisy environment. You cannot, under such conditions, pick up beginning or slight loss of hearing.

It is comparable to testing eyes in a room so dark that neither the doctor nor the patient can see the small type lines; but it is worse, because street noises fluctuate; at one minute it may be in the neighborhood of 20 dcb., at the next, for example, with a passing truck, rising to a 40 level or above.

Proper hearing measurements cannot be made under such circumstances, for it is self-evident truth that mensuration of any kind requires a fixed standard.

It was mentioned at the outset that hearing tests were for two purposes: one to ascertain the degree of loss; the other to ascertain the cause of the trouble.

For the reasons stated I think it must now be seen that for the first mentioned purpose; namely, to discover the degree of the loss, or ascertain the hearing acuity, the electric audi-

ometer and the sound-proof room are indispensable if we want to have accurate data.

As regards the second purpose; namely, the diagnostic, authorities differ as to the value of the audiometric curve alone.

Personally, I do not feel that we have yet reached the point of complete dependence upon the curve. I believe that the tuning fork, with all its imperfections, still has a place in the diagnostic proceeding. Used with due regard to liable fallacies, it can give valuable information as to bone conduction.

Nevertheless, since accurate knowledge of hearing acuity is a preliminary requirement in a diagnostic examination, the audiometer, as well as the sound-proof room, are in this connection indispensable.

With regard to the upper end of the scale, if you have an audiometer that goes high enough and is properly calibrated, you will have the best of all means available for testing in this important area.

Going high enough means going at least to 4,096; but still higher frequencies should be tested. Audiometers that go the very highest end of the scale are very expensive and generally only found in the physical laboratories.

The magnesium forks, as made by the Riverside Laboratory, can now be obtained as high as 20,000, the normal human limit. If properly used these will prove very satisfactory for practical purposes in ascertaining upper tone sensitivity.

From what has been said, it is evident that hearing tests as generally done are full of fallacies, but fortunately we have still left some fundamental facts.

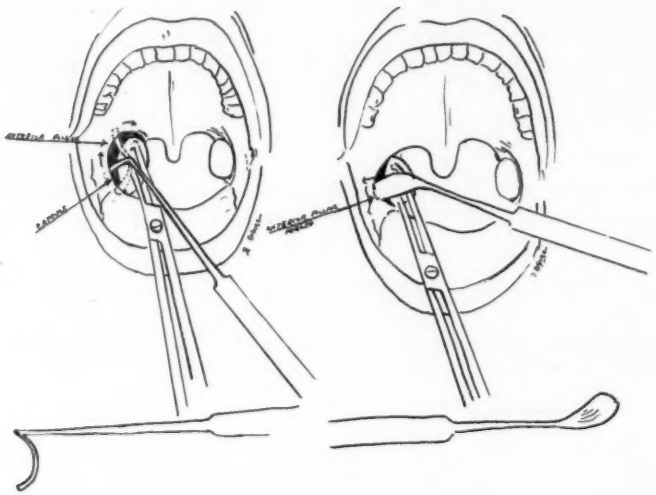
If we only keep well in mind these fundamental facts, and at the same time take due precaution to avoid the fallacies, we may gather a fund of information very helpful in the exploration of an exceedingly important function.

1606 Twentieth Street, N.W.

SUCTION—TONGUE DEPRESSOR.

DR. S. P. SCHECHTER, New York.

This instrument combines the application of suction to the tonsil fossa and surrounding area, together with a convenient tongue depressor, thus eliminating the use of an extra instrument or the possibility of assistants getting in the line of vision of the operator.



The anesthetist or assistant may then stand at the opposite side of the operator, instead of the conventional place at the head of the table, and with one hand depress the tongue and apply suction when required. It is very useful in search of bleeding points, and in preventing blood and foreign material from entering the larynx during an adenoidectomy.

The instrument consists of a substantial handle with a suction vent or release, prominently situated on the handle so as to be easily located by the operator's thumb for controlling the suction. The tongue blades, which are of two different

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sizes (large and small), are quickly and easily adjusted to the handle of the instrument. Each tongue blade has five sizeable holes arranged around the front outside edge of the blade. These holes run through the length of the blade and connect up to the curved shank on the handle of the instrument. As these holes travel the length of the blade they con-

Suction Tongue Depressor.

verge toward and meet the center hole. The blades at no time can become blocked up, as a simple pipe cleaner can be run through the holes for a thorough cleaning.

The shank to which the blades are fitted can also be removed from the handle for cleaning. The entire assembly is rustless, being made of bronze, finished in a durable chromium plate.

This instrument is manufactured by Harry Wregg, Inc., 226 East 23rd street, New York, whose advertisement appears on page 6 of this issue.

1749 Grand Concourse.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

Meeting of Nov. 15, 1937.

Unilateral Exophthalmos. Dr. Guy M. Maness.

W. O. W., male, age 3 years, first seen Oct. 22, 1937. History obtained was that seven weeks previously a small furuncle on the left side of the nose, near the tip, was accidently broken open by a fall in which the nose was struck against a piece of furniture. The furuncle promptly healed and nothing unusual was noted until three weeks later, when the parents, on arising in the morning, noted a marked protrusion of the globe of the left eye. They had not previously noticed anything wrong with the eye. During the next four weeks there was slight increase in the exophthalmos of the left eye. The boy seemed well and did not make any complaints. There was no evidence of an upper respiratory infection, and nothing to suggest a sinusitis. No chills; temperature taken on numerous occasions had never been elevated; the patient had never talked, apparently due to mental retardation, but he seemingly had had no pain; however, frequently rubbed his eye; no redness or edema of the globe or conjunctiva; there was some lacrimation, but no purulent drainage from the eye.

First examination showed boy drowsy, but when aroused very irritable. Temperature was 98.6°; right eye was normal in all respects; there was marked exophthalmus of the left eye; there was slight edema and redness of the upper lid and a rather marked dilatation of the veins. The lower lid appeared normal. The globe of the eye appeared white and there was no definite edema of either the tarsal or bulbar conjunctiva; lacrimal apparatus was normal; pupil dilated and showed only slight reaction to light; there was marked limitation of all extraocular movements. The intraocular tension was normal. Pressure backward on globe of eye caused no recession of the eye, but did cause pain. There was no increase in the anteroposterior diameter of the globe. The fundus was normal except for slight dilatation of the veins and some pallor of the optic disc. There was no pulsation of the globe and no bruit could be heard over any region of skull or over the large neck vessels. A small, rather firm mass was felt between the superior-medial orbital wall and the globe of the eye. Both physical and X-ray examinations failed to reveal any evidence of sinusitis or any other respiratory infection. The remainder of the physical examination was negative, except for definite chronic tonsillitis. X-ray of the orbit showed some increased density, but no evidence of any bone abnormality. Urine negative; W.B.C. 23,400, with 87 per cent polys.; R.B.C. 4,200,000, Hb. 10.4 gms., Wassermann negative.

Five days after the patient was first seen there had developed some edema of the upper tarsal conjunctiva and the medial portion of the bulbar conjunctiva; the globe of the eye was more prominent; highest temperature was 100°, and there was slight blurring of the disc margins of the left eye only.

Oct. 22, 1937, a large caliber needle was inserted into the retrobulbar space through a superior-medial approach and about 5 cc. of thick pus was aspirated. Smears showed staphylococci. An incision was made in the same location and a similar amount of pus was evacuated. The abscess cavity was in very close proximity to the optic nerve and immediately behind the bulb. A drain was inserted. The postoperative course was more stormy than was anticipated. The temperature reached 101.8° the following day and did not exceed 101.2° for the next four days, but on the fifth day following a transfusion there was a chill and the temperature reached a maximum of 102.8°. The following day, sixth postoperative, the maximum temperature was 104°, but

after that it fluctuated with a gradual decrease, until on the tenth postoperative day it reached normal, where it remained until discharge from the hospital on Nov. 7, 1937.

Blood transfusions were given on the fourth, fifth, seventh, eighth, and 10th postoperative days. A lumbar puncture was done on the fifth postoperative day. The findings were negative. Blood cultures on day of drainage of abscess and on fourth and sixth postoperative days were negative. The W.B.C. gradually increased to 37,550 on the sixth postoperative day, but rapidly decreased to approximately normal in the next nine days. During the early postoperative course the patient became very drowsy and listless, and it was thought he probably had a C.N.S. complication, but no localizing signs could be found; however, when discharged, he seemed to have completely recovered. The proptosis was rapidly subsiding. The pupil remained dilated and the nerve head still showed slight edema. Movements of the globe of the eye were improving. It was felt that a large portion, if not all of the vision, would be permanently lost.

This patient had an abscess of the retrobulbar space which apparently was infected by an endophlebitis resulting from a furuncle of the nose. There was probably, also, some extension of the endophlebitis into the cavernous sinus.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

Nov. 17, 1937.

Curable Cases of Meningitis. Dr. Wells P. Eagleton.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

a. From the clinical standpoint:

DR. ISIDORE FRIESNER: I believe one would have to be extremely callous to approach without diffidence the discussion of curable cases of meningitis, especially from the clinical point of view, particularly after the material which Dr. Eagleton has adduced here, an amount which probably cannot be duplicated in the hands of any one other man.

The recent combination of chemical therapy with other methods to cure meningitis has brought this condition again into the foreground of therapeutic effort. I remember the time, say 30 or 35 years ago, when the attitude toward meningitis was one of "laissez faire," and that is exactly what I mean—"Let them go." It is extremely interesting to compare the attitude at that time with that of today; one cannot help but feel that we are at last moving on the right road. I do not mean to say that we are traveling, but we are moving; and if we find, for instance, that we are moving in the wrong direction, we will change the direction but still move, and I believe that is a very salutory condition.

There are too many things about the clinical aspect of curable meningitis for any one man to discuss in a few minutes, but there are just one or two points that I would like to bring to your attention. For instance, in a brief but excellent presentation in the Wiener Klinische Wochenschrift of 1934, Ruttin discusses the operative treatment of meningitis, and rather early in the article he puts to himself the question, "What is meningitis?" a question which agitated him and which still agitates us. Shall we, for instance, accept the formula of Lund, who believes that if one has five or six polymorphonuclear cells per cubic millimeter of cerebrospinal fluid, that is a meningitis; or shall we consider a veritable meningitis only that instance in which there are not only numerous pus cells in the cerebrospinal fluid, but also in which organisms can in some way be demonstrated? I believe there is a lot to be said on both sides and while the attitude of Lund is obviously extreme, it is equally difficult to subscribe unequivocally to the opposite view. Let me illustrate what I have in mind:

A number of years ago a child was brought into the Mount Sinai Hospital with a history of discharging ear for three weeks, and for three days before admission, headache, fever and vomiting. On examination, in addition to the discharging ear and probable mastoiditis, the child had a rigid neck, a Brudzinski and a Kernig. There were 3,600 cells per cubic millimeter in the cerebrospinal fluid with 85 per cent polymorphonuclears, but no organisms. The child's mastoid was operated upon immediately and comparatively little disease was found in that structure. The sinus and the dura over the cerebellum and the temporal lobe were exposed extensively down to the superior semicircular canal and were found to be normal. During the days

succeeding the operation the child apparently made a complete recovery. She had no fever, no headache, no vomiting, and the physical signs of meningitis disappeared. On the twenty-first day following operation, the child sickened again. There was a recurrence of meningeal signs, purulent cerebrospinal fluid and, this time, organisms.

Now, what logical basis could anyone have for the assumption that there was an essential difference between the child's original attack and the second invasion which proved fatal? To me, there was a difference only in degree but not in essence. On postmortem, we found that about 1.5 cm. beyond the exposure of the middle fossa there was disease of the petrous pyramid. If this patient had been explored in accordance with our present knowledge of the extension of disease from the middle ear and mastoid, and if the focus in the pyramid had been uncovered and adequately drained, this child would probably have recovered, as have others under similar circumstances.

The question that agitates me is: Would you classify this case, when it entered the hospital, as a curable meningitis, if you knew the physical condition completely? I would, even though there were no organisms demonstrable in the original lumbar tap.

As I said before, there are too many phases of this question of the curability of meningitis and the methods of cure to be discussed in a few minutes by any single man. I have, however, given the matter considerable thought and I believe that without much strain one can reasonably sum up in a comparatively few words those characteristics of any given case of meningitis which offer the best chance for its cure. First, the meningitis should not have lasted too long. Of course, one can paraphrase that indefinitely, but I remember an instance one or two years ago, when Dr. Eagleton and I saw a case together, a child with meningitis, moribund. Obviously, such a state is beyond any possibility of cure. I am not familiar enough with the question of arachnoid reaction to be able to discuss it intelligently, but I think, by and large, the slower the tempo of the invading focus, the better the chance for the meningitis to be cured. In other words, if you have a fulminating meningitis as an extension from an acute process either in the bone or the labyrinth, in which nature herself has made no attempt at localization in the original focus, such a patient has very little chance for recovery. On the other hand, whether the focus which starts the meningitis be intralabyrinthine, intraosseous, extradural or intramedullary, it should be a well circumscribed focus, as, for instance, a definitely limited epidural or subdural abscess, a localized area of suppuration in the bone, a process in which nature herself has already made some attempt by adhesions to localize the infection. These, I believe, are the factors which enhance the possibility of surgical cure, and in the last analysis, the surgical cure of meningitis is a cure of its focus, wherever that may be.

Dr. Josephine B. Neal: Whenever I hear discussions of meningitis by physicians who have had a vast experience in otolaryngology, such as Dr. Eagleton and Dr. Friesner, I have a deep feeling of regret that my own knowledge of otolaryngology is so limited. My interest in this subject is purely along the line of whether or not a meningitis is present and if so, what type it is, and what can be done about it. Before I forget it, I may say in passing that those two cases of hemolytic streptococcus meningitis that followed scarlet fever were, I can assure you, true cases of meningitis, not toxic manifestations. They showed all the characteristics of a meningitis in addition to the presence of organisms in smear and culture on more than one occasion.

The feeling with which I approach a case of meningitis other than the meningococcic type, at the present time, especially the cases of streptococcic meningitis, has changed a great deal since we have been using sulphanilamide. Before that time, probably 94 or 95 per cent of our cases of streptococcic meningitis died. Of course, most of our cases of streptococcic meningitis were due to the hemolytic streptococcus and most of them were secondary to demonstrable foci of infection either in the ears or the sinuses. Since we

have been using sulphanilamide, about 80 per cent of the cases of hemolytic streptococcic meningitis we have seen have recovered. Otherwise, our treatment has been just about the same over a period of years. I think we cannot emphasize too much the points which Dr. Eagleton and Dr. Friesner have already made, that the removal of the focus of infection is extremely essential to the recovery of a case of meningitis. If a focus of infection remains, in 99 cases out of a 100 it can manufacture organisms more rapidly than sulphanilamide or sulphanilamide and serum, or anything we can do can take care of them. Therefore, when we see cases that have not been operated, in which the focus of infection can be located, we always urge operation. I think that all of us are impressed by how often, in the case of young children particularly, a really active mastoid may be present, although it shows no clinical signs and even an X-ray examination may be indefinite. I recall a case that had a happier ending than the one Dr. Friesner reported. A few years ago, I saw a child who had had an otitis media from a hemolytic streptococcus. Then, after a period of apparent recovery, the child showed signs of meningeal irritation, high fever, stiffness of the neck, and so on. Lumbar puncture that afternoon showed about 2,000 cells, but no organisms in the smears and a normal sugar content. When I saw the child that evening, the spinal fluid was the same. Incidentally, both spinal fluids failed to reveal any organisms on culture. I gave the child streptococcus serum because I knew the otitis media had been due to the streptococcus. It was impossible for an otolaryngologist to be located that evening, so that I did not see the case with him, but I begged them to urge the surgeon to operate whether or not he could find demonstrable signs over the mastoid. Signs were not found, but fortunately he did operate and found an active mastoiditis. From that time on, the child began to recover.

I have been in the habit of calling that type of reaction a serous meningitis. I do not apply the term "meningitis" unless organisms can be demonstrated. Of course, sometimes all the spinal fluid shows is a high increase of cells and low sugar. One may not be able to demonstrate the organism and one has to call it meningitis, type undetermined. However, we do see these cases of serous meningitis where the focus of infection is removed or through a kind providence the infection quiets down and recovery takes place. All too often, however, this is the preliminary stage to a bacterial meningitis.

We think that it is helpful in these cases, and indeed necessary, to do repeated lumbar punctures. For a time, some years ago, we tried forced spinal drainage. Our lack of success with it led us to stop it after it had been tried upon what seemed to us an adequate number of cases. If a specific serum is available, we have been in the habit of recommending it, in addition to the sulphanilamide. It has been shown by experimental work that the action of sulphanilamide and specific serum, experimentally, is better than the action of either one alone. We do not know, of course, exactly what the action of either one is.

Since our work with sulphanilimide we have seen three cases of pneumococcic meningitis recover, the only cases we have seen recover in our rather long experience in dealing with meningitis. These were all odd types.

I suppose there are other factors in addition to those which Dr. Eagleton has already brought out, such as the virulence of the organism. Unfortunately, it is not very easy to evaluate the virulence of the organism after we recover it, because the virulence in animals is apparently not always parallel to the virulence in man as demonstrated by the disease reaction in the patient. In addition to that, the resistance of the patient varies, due to factors that we do not understand.

Most of us who have worked with sulphanilamide feel that it has added greatly to the chances of recovery, especially in the hemolytic streptococcus type of meningitis.

b. From the pathological standpoint:

DR. JOSEPH G. DRUSS: After listening to the excellent and comprehensive presentation by Dr. Eagleton and the discussion by such authorities as Dr. Friesner, Dr. Neal and Dr. Dwyer, any comments that I make may only be superfluous; however, there are one or two points in the discussion which I would like to emphasize from the pathologic standpoint:

Within the past few years our attention has been concentrated on suppurations of the petrous pyramid and their complications. Ever on the lookout for these conditions, we must not lose sight of the fact that the meninges may be involved directly from the tympanum, mastoid, zygoma and accessory sinuses. With your permission, I should like to demonstrate a few slides which illustrate an extension of the infectious process from these latter sources to the meninges, and to omit at this time the cases of meningitis secondary to suppuration of the petrous pyramid.

The dura, as is well recognized, constitutes a strong barrier to the extension of the infection from the bone focus to the intracranium. Under certain circumstances, however, this barrier breaks down and invasion of the meninges takes place. The picture of a fulminating meningitis appearing shortly after the onset of an acute middle ear suppuration is only too well known to every otologist.

A study of the histologic sections of the temporal bone very often discloses the pathway through which the infection spreads from the bone to the intracranium. At times, however, in spite of careful search the pathway cannot be ascertained. Also, there are instances in which a meningitis of otitic origin is suspected but the primary focus and extension of the avenue of infection to the meninges are disclosed, not in the temporal bone but in the accessory nasal sinuses, revealed only by histologic sectioning of the latter. These observations are in accord with those made clinically by the speaker.

Presentation of lantern slides: The first slide demonstates the protective properties of the dura. It represents a section of the dura obtained from a patient who died of meningitis of unknown etiology and on whom search was made for a possible extradural abscess during a mastoid operation 10 days previously. The plastic exudate intimately adherent to the outer layers of the dura is demonstrable. The long strands of fibres in the meshes of which are mingled polymorphonuclear leukocytes, lymphocytes and plasma cells, can be seen. The inner layers of the dura exhibit little evidence of inflammatory reaction. This slide demonstrates the practical point, that while the dura should not be exposed injudiciously during operation, there need be no hesitation of its exposure when the occasion demands.

The second slide demonstrates an instance in which the dura was capable of warding off a chronic infectious process of the middle ear with cholesteatoma of 30 years' standing. With the onset of an acute exacerbation, however, there soon appeared signs of a temporal lobe abscess. The patient succumbed to a subsequent meningitis. The cholesteatoma in the tympanum, aditus and antrum can be seen. The erosion of the cortex of the roof of the antrum by osteoclastic resorption, the extradural collection of purulent exudate, the extensive thickened and inflamed dura and the intradural abscess represented by the pedicle of granulation tissue on the dura are demonstrable. To this pedicle the temporal lobe abscess was attached.

The third slide is a sagittal section of the sphenoid obtained from a patient who died of meningitis of unknown etiology. Because of a perforation in the tympanic membrane, the possibility of an otitic meningitis was considered. Examination of nose and throat was essentially negative. X-ray examination revealed a slight thickening of the mucosa of the sphenoid. By postmortem examination no gross break through the dura of the temporal bone could be seen. Removal of the pituitary gland, however, disclosed an undue amount of purulent exudate in the sella turcica. Histologic examination of the temporal bone ruled out this structure as the primary focus. Sections of the sphenoid revealed the source of the meningitis and its route of extension. The

necrosis of the roof of the sphenoid, the excessive amount of purulent exudate in the subdural space and in the cavernous sinus can be observed.

It is indeed a privilege to participate in this discussion.

DR. ANDREW A. EGGSTON: I am very appreciative of what all the speakers have said who preceded me, and have been taught a lot this evening. I am not going to say very much as the hour is so late, and I should not show any lantern slides, but I do it for one reason more than anything else. Since so much is being done in the surgery for suppurative meningitis, we pathologists can add something by a thorough study of the tissues in the region of the cranium which act as foci of infection. There are not many institutions which have facilities for running serial bone sections in rather large dimensions.

Presentation of lantern slides: 1. Serial sections of the petrous bone to demonstrate some of the pathways of infection. 2. Demonstration of pathway into the meninges. 3. Middle ear of a child, age 4 months, with a middle ear infection, the cochlea filled with pus and the stapes dislocated. This may have happened at the time of paracentesis. 4. The ductus endolymphaticus. 5. The ductus endolymphaticus where it continues on down and becomes the saccus endolymphaticus. 6. Another section showing the ductus cochlearis, another pathway for infection. 7. A case of meningitis where the infection may have traveled through the ductus cochlearis or not. We must always bear in mind that pus can come from the meninges outward, as well as from the middle ear and other nerve sheaths, into the meninges. 8. Cholesteatoma of the petrous pyramid. This patient later had a chronic ear and developed a brain abscess. 9. Chronic osteomyelitis of the petrous tip. The patient died of a temporosphenoidal abscess. 10. A case showing abscess and osteomyelitis. 11. Chronic osteomyelitis showing thickened trabeculae of bone and an abscess at the tip of the petrous bone. 12. An old mastoid and a pneumatic petrous tip (normal specimen). 13. The same case showing an abscess low and toward the posterior surface of the petrous tip. The patient succumbed to a meningitis. The outcome might have been different if this focus of infection had been removed. 14. An abscess on the posterior surface of the petrous pyramid. 15. Dissection of the mastoid with a probe through the mastoid wound, showing the petrous tip and middle fossa. In this type of case we have had the best results from surgery. We have had several of these cases of so-called meningitis which have recovered. They had bacteria in the spinal fluid on culture. 16. Demonstration of the relationship of the sphenoid sinus to the sella turcica and pituitary gland. Sometimes the bony plate is absent and the dehiscence in the bone is simply covered by membrane. 17. Olfactory nerve and its sheath filled with pus. The infection traveled from the sinus up and around the olfactory nerve following surgery. It may have appeared to be a case of meningitis with pus extending downward into the nerve sheath if the history were unknown. Sometimes it is very difficult to know which way the infection traveled. 18. Sinus thrombosis and meningitis. 19. Demonstration of the difficulty in curing cases of meningitis. The arachnoid is filled with exudate. In most cases of meningitis there is a suppurative thrombophlebitis. These small vessels frequently rupture, spreading bacteria all over the brain.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTOLARYNGOLOGY.

Dec. 15, 1937.

Laryngofissure for Removal of Intrinsic Cancer of Larynx. Dr. Arthur Palmer.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

Myxochondroma in the Nose of a Child Eight Months Old. Dr. Gervais N. McAuliffe.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

A Short Report on the Use of a New Local Anesthetic Agent Which Gives Prolonged Analgesia. Dr. W. Wallace Morrison.

(To be published in a subsequent issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. ALEXANDER F. LASZLO: Dr. Morrison's paper on procaine eucupin anesthesia was very complete. I have had my own experience with about 300 cases which we had this year at the Post-Graduate Hospital, and I will speak about my clinical experience, and say nothing about the pharmacology of the drug.

The first thing which is very important, and which Dr. Morrison spoke of, is the slow diffusibility of the drug. This is very important in its clinical use. There must be at least five to ten minutes elapsing between the time of injection of the drug and operation. The second condition, is that the anesthesia must be perfect. In those cases where not enough time has elapsed between injection and operation, the patient will usually feel pain, even though it is combined with procaine, and if the anesthesia is not perfect, the patient will also feel pain. However, if the anesthesia is perfect, there will be no pain during the operation, and for some time after it.

As to the after effects of this anesthetic, it is a very difficult thing to judge when a patient will have pain after a tonsillectomy. This question is a very important one to decide, before we can pass judgment on a drug like this one mentioned by Dr. Morrison. We tried injecting this drug only on one side. I had 25 cases. My experience was not similar to that of Dr. Morrison. Many patients complained of more pain on the side injected with procaine eucupin than on the other side. Later we injected procaine eucupin on both sides, and in these cases we had much better results. If the operation was done under perfect anesthesia, the patients had no pain after the operation for six, eight or ten, or even 12 hours afterward, and sometimes even longer. The majority of the patients will complain of a slight soreness of the throat, which is increased upon swallowing. Therefore, I think it advisable to give a postoperative medication. On many of my patients I tried to touch and press on the pillars with a blunt probe, four, six and 12 hours after the operation, and almost all of them reported absolutely no pain. I had occasion to prove the prolongation of the anesthesia in two of my patients who had a postoperative oozing; one, for three hours,

and the other, five hours after completion of the operation. None of these patients complained of any pain while the oozing was stopped.

As Dr. Morrison mentioned, there will be a slightly increased bleeding in the majority of the cases. However, it is not to such a degree that it would interfere with the operation. But is is very important to have the fossa completely dried, to avoid any postoperative bleeding.

I did not observe any adverse reaction in any of my patients where I used infiltration anesthesia. However, I had one patient who had developed a strong erythema after using the injection of procaine eucupin, 1 to 1,000, intravenously. Large blotches appeared over the entire body, and a very marked itching which continued for two days. After this time these symptoms disappeared without giving any further disturbance.

As Dr. Morrison said, in the beginning we used 1 to 1,000 solution, but inasmuch as I saw there were no adverse reactions, I induced the firm to increase it to 1 to 500 solution, and have been using this for some time now. I believe this solution gives a better result as far as the prolongation of the anesthesia.

Due to the fact that I think eucupin procaine is superior to plain procaine solution, I am using eucupin procaine anesthesia routinely in all my tonsillectomies with great satisfaction. As to the eucupin in ointmnet form, my experience with such is too small to form a satisfactory judgment. Therefore, I would rather not go into the discussion.

(To be continued in a succeeding issue.)